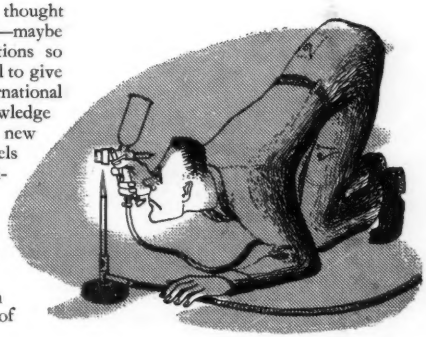
INDUSTRIAL
FINISHING
ENGINEERS LIBRARY
College Station, Texas
MAR 27

Cutting Costs

Perhaps you have already thought about the Hot-Spraying Process—maybe disappointed in your investigations so far—so why not ask International to give their impartial advice? International Paints Ltd. have particular knowledge of this process and offer entirely new types of high solid content enamels and lacquers for all trades including the coach trade in particular. Available in both air-drying or stoving qualities. *Handling and power costs are saved because:*

1. One coat gives a finish superior to 2/3 coats of normal cold-spray.
2. No thinners are required.

With this new finish a complete transport bus can be painted in 10-15 minutes. What savings do you think you could effect in your paintshop?



★ *Take the first step now and write or phone International. An Advisory Service backed by technical knowledge is at your disposal.*

International Paints Ltd.

Head Office: **GROSVENOR GARDENS HOUSE, LONDON, S.W.1.**

TELEPHONE: VICTORIA 3161 (10 LINES) *TELEGRAMS: CORROFOUL, SOWEST, LONDON*

Branches at: Cardiff, Glasgow, Hull, Liverpool, London, Newcastle, Southampton, West Hartlepool.

REGISTERED TRADE MARK

MAIN FACTORY IN U.K. FELLING-ON-TYNE

ASSOCIATED FACTORIES AT

BERGEN	NORWAY	KOBE	JAPAN	SAN FRANCISCO	U.S.A.
BILBAO	SPAIN	LE HAVRE	FRANCE	SYDNEY	AUSTRALIA
COPENHAGEN	DENMARK	MEXICO CITY	MEXICO	TRIESTE	ITALY
GENOA	ITALY	MONTREAL	CANADA	VANCOUVER	CANADA
GOTHENBURG	SWEDEN	NEW YORK	U.S.A.	WELLINGTON	NEW ZEALAND
HAMBURG	GERMANY	RIO DE JANEIRO	BRAZIL		

THE NEW APPROACH TO OLD PROBLEMS
EFFLUENT DRAINAGE IN POLYTHENE.
INDUSTRIAL FABRICATED PLASTICS
P.V.C. DUCTING FOR ACID FUME EXTRACTION
LIP TYPE ACID FUME EXTRACTION UNITS IN P.V.C.
RIGID P.V.C. LININGS FOR PLATING TANKS, ETC.

PRODORITE LTD

ENQUIRIES TO

HEAD OFFICE: EAGLE WORKS · WEDNESBURY

TELEPHONE: WEDNESBURY · 0284 · 5 LINES

LONDON OFFICE: ARTILLERY HOUSE · LONDON, S.W.1

TELEPHONE: ABBEY 3816 · 5 LINES

ECCO

offers the

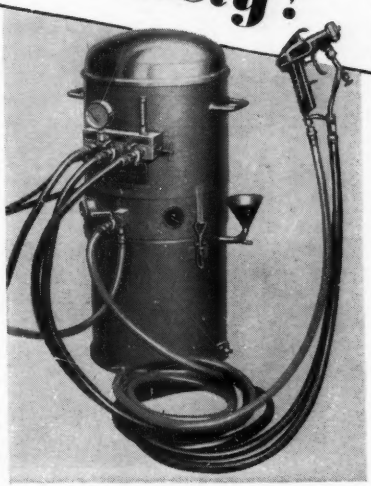
HOT SPRAY PROCESS

in safety!

'ECCO' has these advantages:
High output • Constant temperature and pressure maintained in fluid hoses up to 30 feet from the unit • Suitable for spraying lacquers, enamels and primer surfacers.

'ECCO' pays for itself on the first 250 gallons of paint you spray by the hot process.

'ECCO' saves time once through the drying oven does the job—instead of twice—and reduces 'flash-off' times through Radiant Heat tunnels.



'ECCO'

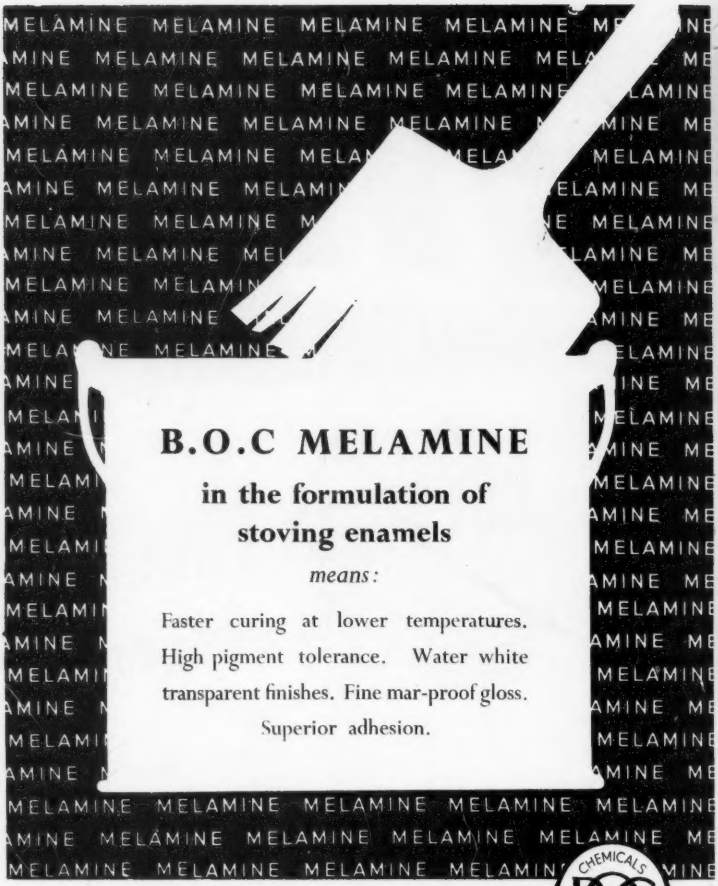
HOT LACQUER SPRAYING UNIT

Manufactured by **The Atlas Diesel Co. Ltd.**

Enquiries are invited.
Demonstrations can be arranged locally. Write to:-

THE ATLAS DIESEL CO. LTD., Department P.2
Beresford Avenue, Wembley, Middlesex, Wembley 4426-9

Service Depots:- MANCHESTER • LEEDS • GLASGOW • BIRMINGHAM
NEWCASTLE • BRISTOL • CARDIFF • NOTTINGHAM • BELFAST • DUBLIN
JERSEY (C.I.)


MELAMINE
B.O.C MELAMINE
in the formulation of
stoving enamels
means:
Faster curing at lower temperatures. High pigment tolerance. Water white transparent finishes. Fine mar-proof gloss. Superior adhesion.

for supplies and prompt service write to:

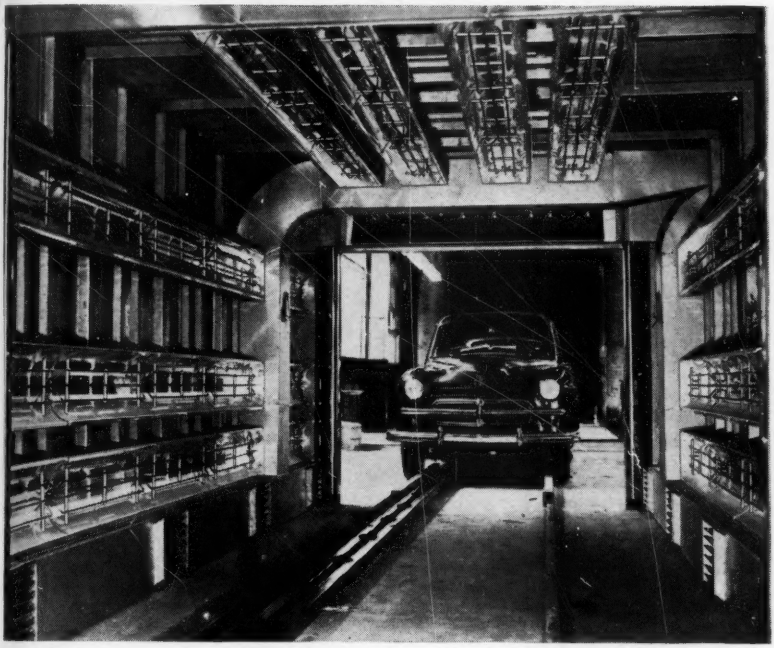
CHEMICALS DIVISION

THE BRITISH OXYGEN CO LTD

VIGO LANE CHESTER-LE-STREET CO. DURHAM

Telephone: BIRTLEY 145

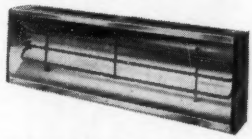
Metrovick Infra-Red speeds the cars . . .



A Vauxhall car in front of one of the four Metrovick Infra-Red drying ovens.

VAUXHALL MOTORS LTD have recently installed at their Luton factory four Metrovick Infra-Red ovens, arranged as two pairs. The first oven dries moisture off the car after water spraying and takes only FOUR MINUTES; the second oven dries any spotting of cellulose paint necessary before the finished car leaves the factory. The drying time in this oven is about THREE MINUTES.

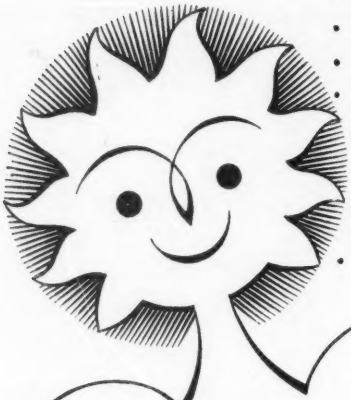
The basic element projector, shown opposite, is made in standard sizes, 18 in. 24 in. and 36 in. long, and special lengths can be supplied. The source of radiant heat is the Metrovick tubular-sheathed heating element, an industrial adaptation of the successful "Redring" domestic element



Our Heating Element Department will be glad to discuss your heating problems, and the demonstration rooms at Trafford Park, Manchester and 132/135 Long Acre, London are open for inspection and the actual testing of samples.
Descriptive leaflet 703/7-1 will be gladly sent to you on request.

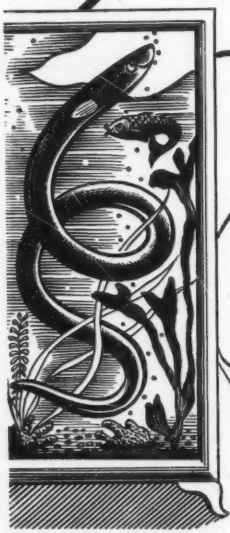
METROPOLITAN-VICKERS ELECTRICAL CO. LTD., TRAFFORD PARK, MANCHESTER 17
Member of the A.E.I. group of companies

METROVICK *Infra-Red turns hours into minutes*
L/S201



I, too, am unusually flexible!

Gas has claims to be the most generally versatile and flexible fuel known to man. There is almost no limit to the variety of gas-fired equipment and appliances either available or designable. For jobs big or little, straightforward or intricate, flow-production or 'one-off', gas nearly always turns out to be the simplest to install, the easiest to maintain and the most economical to operate. There's no handier man at a heating job than Mr. Therm.



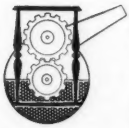
MR. THERM HELPS IN INDUSTRIAL FINISHING

He makes himself very useful in vitreous enamelling, drying by natural or forced convection, radiant heat drying, paint curing and metal finishing of all kinds of articles.

Mr. Therm burns to serve you

THE GAS COUNCIL · 1 GROSVENOR PLACE · LONDON · SW1

Four ways to cut costs, boost business



Polykem, the brilliant quartet of industrial finishes based on Berger-developed styrenated alkyds, proves its superiority in the way that means most—it raises sale figures. And, equally important, each air- or stove-drying Polykem finish possesses a technical efficiency that cuts costs all along the line. Polykem finishes dry faster. They have the smoothest, easiest flow, the longest lasting gloss, the firmest adhesion, *the most remarkable economy*. If you would like to hear more, send a postcard—mentioning your manufacturing interests—to the address below for details of the application of Polykem Industrial Finishes to your particular products.

Berger

POLYKEM INDUSTRIAL FINISHES

Manufactured in accordance with British Patents 573809, 573835, 580912, and other British, Dominion and Foreign Patents pending or granted.

ARE THE START OF SALES

LEWIS BERGER (GREAT BRITAIN) LTD.
BERGER HOUSE, BERKELEY SQUARE, LONDON, W.1

2B/9

Electrify production—

use G.E.C.

ELECTRIC Process Heating

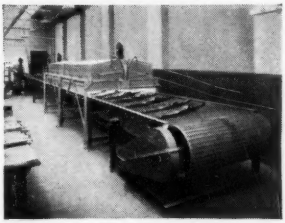
FURNACES · INFRA RED · HIGH FREQUENCY

● Bold thinking about bigger production demands new methods of heat treatment. G.E.C. *electric* process heating ensures maximum output and true economy. The many heating equipments in its range are clean, safe, simple to operate, and heat rapidly to constant correct and controlled temperatures. Its versatility is being proved every day.

● It has unlimited applications: from paint drying and stoving in light industry to bright annealing and brazing in heavy industry. For example, it is widely used for industrial finishing on all mass production lines.

● G.E.C. has had many years' experience in the design and construction of heating plant. The company's specialists welcome opportunities to discuss potential uses with engineers and metallurgists.

Infra-Red Heating



G.E.C. INFRA-RED LAMP PLANT

The accelerated drying and stoving of synthetic resin and cellulose based finishes by infra-red heating reduces drying time from hours to minutes. Objects of all shapes and sizes are covered from refrigerators to powder compacts. Besides sheet metal work, it can be used for finishing wooden cabinets and furniture without causing blistering or distortion and with reduced sinkage. The finish may be pigmented or transparent, to show the natural beauty of veneers.

● **ELECTRICITY ENSURES TRUE COAL ECONOMY**

THE GENERAL ELECTRIC CO., LTD. MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Take a tip from me . . .

FOR BRIGHT NICKEL WITHOUT ANY FINISHING THERE'S NOTHING BETTER THAN . . .

CANNING

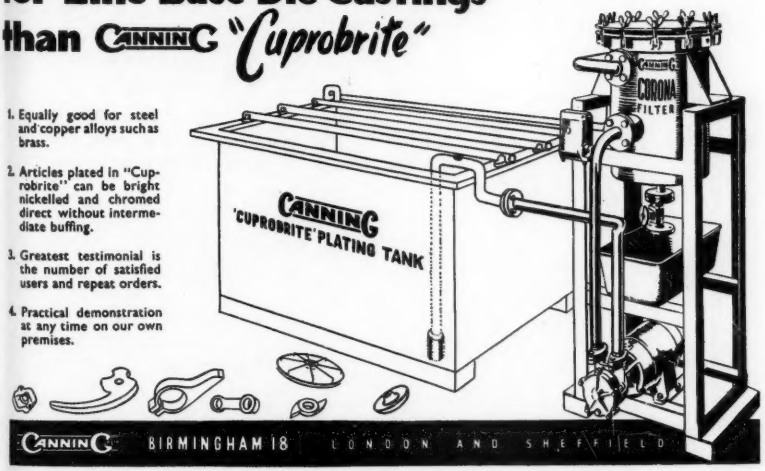
'SUPER GLEAMAX'

with 'LEVELBRITE' the new single addition agent. Unequalled Brightness of Deposit and Superior Levelling at Greatly Reduced Cost with Simplicity of Maintenance.

W. CANNING & CO. LTD. BIRMINGHAM LONDON SHEFFIELD

there is no better *Bright Copper* Solution for Zinc Base Die Castings than CANNING "*Cuprobrite*"

1. Equally good for steel and copper alloys such as brass.
2. Articles plated in "Cuprobrite" can be bright nickelled and chromed direct without intermediate buffing.
3. Greatest testimonial is the number of satisfied users and repeat orders.
4. Practical demonstration at any time on our own premises.



CANNING BIRMINGHAM 18 LONDON AND SHEFFIELD

For over 150 years . . .

Since 1802 Parsons have been makers of fine paints for all purposes. During this time they have always marched in the vanguard of scientific research and constantly striven after new and better formulas for paint products. Today — the name of PARSONS still proudly stands as a symbol for quality and durability and is still regarded as such by discriminating paint users everywhere.

the better finish for all good jobs— Parsons

THOS. PARSONS AND SONS LTD., 70, Grosvenor Street, London W 1. MAYfair 7951 (10 lines)
Branches: Beaconsfield, Birmingham, Brighton, Cardiff, Dublin, Edinburgh, Glasgow, Manchester, Plymouth & Southampton.

What's in a name?
. . . PRODUCTS THAT ARE WORTHY CARRY THEIR NAMES PROUDLY AND BEAR THE STAMP OF QUALITY . . .
KAYLEE
TRANSFERS
ARE WORTHY TO BRAND YOUR GOODS
Tell us your requirements—
KAYLEE TRANSFERS LIMITED
WEST END MILLS · LONG EATON · NOTTS
—Phone Long Eaton 692
WEST WAY GARAGE
SKEGNESS
BELLAMY BROS
DRINKS
Esso
MEMBER
KAYLEE — The Hardest Wearing Transfers in the World

For a FINE FINISH

— so essential to a fine product —

You need

MODERN STOVING & DRYING PLANT

Our extensive experience in the application, design and production of all types of OVENS—Stationary and Conveyor for all enamelling, lacquering, cellulose finishing and every drying operation by Convection and Infra-Red process—is freely at your service.

We also specialise in Dust Extraction Systems for Polishing and Grinding operations and Wood Working machinery, Fume Extraction and Ventilating Systems, Tanks for all Industrial Processes, Storage, etc.

Get in touch NOW.

Telephone: Smethwick 1571-2-3-4
Telegrams: "Grifoven, Smethwick"

GRIFFITHS *the* **SATISFACTORY PLANT**

A.E.GRIFFITHS (SMETHWICK) LTD. BOOTH ST, HANDSWORTH, BIRMINGHAM.

Clinton-Wall

THE WORLD'S FINEST GUN

FOR LARGE SCALE INDUSTRIAL PRODUCTION

The A.I.D. Model 7 Gun falls right into line with the need of industry to effect increased production and saving of man-hours. This gun has been put to every known scientific and practical test, and its economical performance and mechanical perfection have made it the outstanding choice of great industrial organisations all over the world.

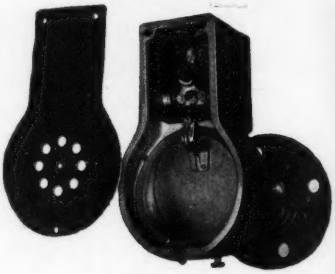
AND THE WORLD'S FINEST SERVICE

No service can excel the A.I.D. INSTANT RESERVE REPLACEMENT SERVICE, which ensures 100% man-hour efficiency every hour of every day—New or reconditioned guns are exchanged instantly for your worn or damaged guns. A.I.D. not only supply guns, but EVERYTHING behind the gun. Whether your needs are large or small, do not hesitate to request the services of our technical organisation.

CONTRACTORS TO THE WAR DEPARTMENT OF THE U.S.A.

Sole Manufacturers: AIR INDUSTRIAL DEVELOPMENTS LIMITED, Aidspray Works, Shenstone, nr. Lichfield, Staffs, England. Phone: Shenstone 341/5. Grams: Aidspray, Shenstone. LONDON, 28 South Molton Street, W.1. Phone: Mayfair 6318. Grams: Aidspray, Wesdo.

AIR FLOW SWITCH



DETAILS ON REQUEST

- **This switch operates as a protective device in all cases where the maintenance of a continuous flow of air is of importance.**
- **A totally enclosed mercury switch ensures absolute reliability even under the most adverse conditions of dust and dirt and also provides complete protection against risks of explosion through sparking contacts in an atmosphere charged with inflammable vapours.**
- **The switch may be used in an ambient temperature up to 350° C. and will operate on a differential as low as 0·1" w.g.**
- **The mechanism functions on air pressure or suction against the restoring force of gravity; no springs of any kind are used.**

DELTA TECHNICAL & COMMERCIAL SERVICES LTD.

ELEKTRON WORKS, SYDENHAM ROAD LONDON, S.E.26

Phone: Sydenham 4710. Grams: Deltcos, Forest, London

free from grease and ready for a perfect finish

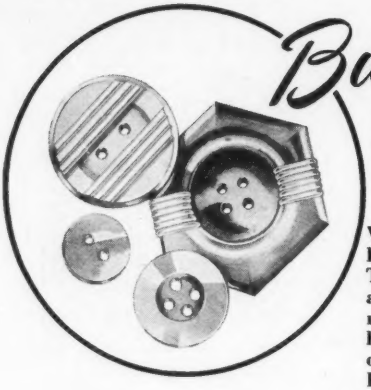
One degreasant will not fulfil all degreasing requirements. If, therefore, you are experiencing difficulties let the B.H.C. Laboratory Service solve your problem — without obligation. There are many grades of Collex at your disposal.
Write or phone today for a Technical Representative to call.

COLLEX
DEGREASANTS

will banish any greasy deposit

B.H. CHEMICALS LTD. Merton Abbey Laboratories
Abbey Road, London, S.W.19 Tel: LIBerty 1021 (4 lines)

Associated Companies: *Colloidal Detergents of Australia Ltd., Sydney, Australia. Chemical Services (Pty.) Ltd., Johannesburg, South Africa. And at Copenhagen, Amsterdam, Brussels, Paris, Lille, Lyons.*



Buttons and Paint?

Whatever the product there's a specialised Kearsley Industrial Finish fit for the purpose. These specialised finishes, formulated, tested and produced to suit individual requirements, can be relied upon for consistently high performance under actual working conditions — on their reputation alone Kearsley Industrial Finishes are used and specified in all walks of Industry.

Hammer Finishes (Stoving and Air Drying)—Heat Resistant Enamels—Wrinkle Finishes.—Polychromatic and Flamboyant Finishes—Acid and Alkali Resistant Coatings—Hot Spray Finishes — Stoving and Air Drying materials.

Robert Kearsley & Co. RIPON — YORKS

"DURING TIMES SUCH AS THESE WHEN SHORTAGES OF METALS AND MATERIALS OFTEN MAKE OUR STANDARD FINISHES EXPENSIVE OR PROHIBITIVE, A BOOK ON INDUSTRIAL FINISHES IS BOUND TO BE OF ASSISTANCE AND USE. THE *INDUSTRIAL FINISHING YEAR BOOK* . . . WHICH DEALS WITH EVERYTHING FROM DEGREASING AND CLEANING TO APPLICATIONS OF PROTECTIVE AND DECORATIVE FINISHES, IS CERTAINLY A 'MUST' FOR ANY PRODUCTION FIRM."

". . . A reference book to be consulted when finishes are desired, the book can also be read with profit in order to improve our knowledge of techniques and processes, because informed articles appear, giving details of many processes and methods."

Techniview, 12.6.52.

INDUSTRIAL FINISHING

YEAR BOOK

Available FREE to subscribers to the monthly journal "Industrial Finishing" (30/- per annum post paid). Additional copies 15/-.

ARROW PRESS LIMITED, 157 HAGDEN LANE, WATFORD

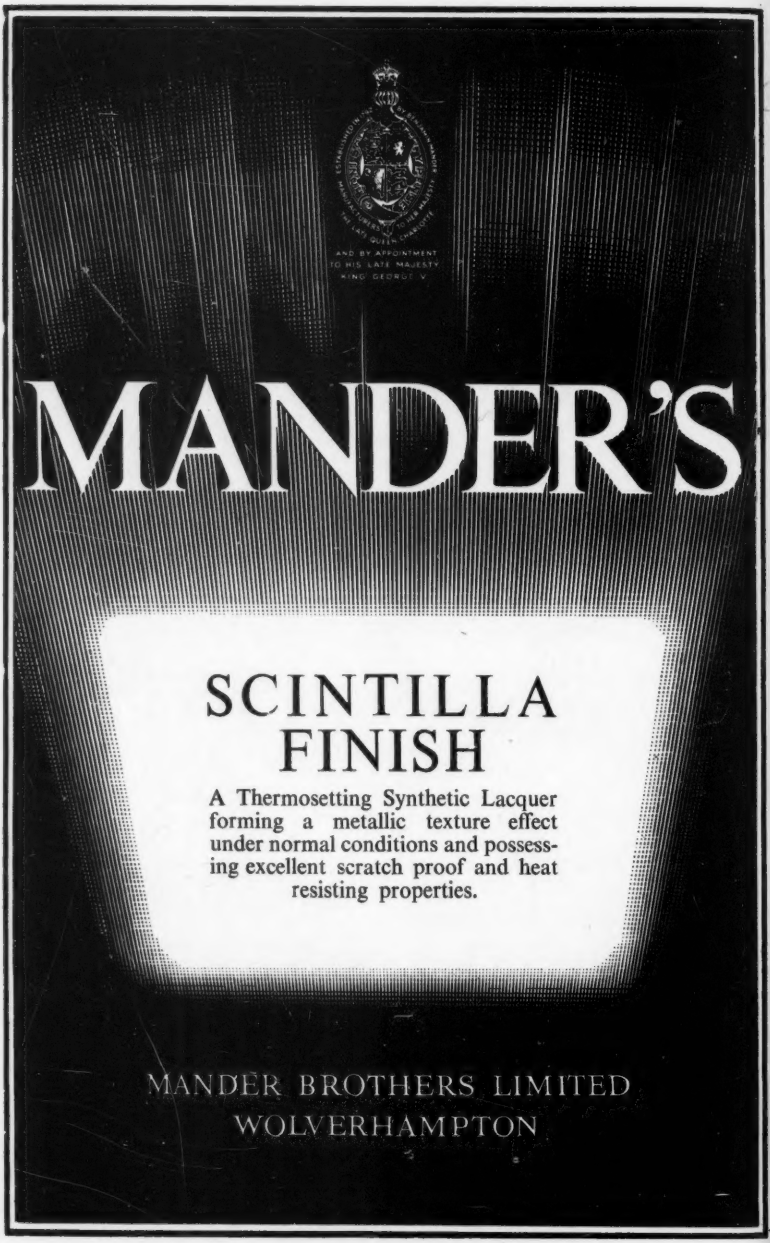
1ST FOR FINISHING!

Goodall Brand

POLISHING COMPOSITIONS

- Tripoli Compositions
- White Finish
- Green Chrome Composition
- Stainless Steel Composition
- Rouge
- Pumice Composition

JOHN HAWLEY & CO. (WALSALL) LTD.
GOODALL WORKS
BLOXWICH ROAD, WALSALL, STAFFS
Established 1837
Telephone: BLOXWICH 66251 Telegrams: ROPE, WALSALL


AND BY APPOINTMENT
TO HIS LATE MAJESTY
KING GEORGE V
MANDER'S
SCINTILLA
FINISH
A Thermosetting Synthetic Lacquer forming a metallic texture effect under normal conditions and possessing excellent scratch proof and heat resisting properties.
MANDER BROTHERS LIMITED
WOLVERHAMPTON

EDITORIAL DIRECTOR:
DR. W. F. COXON,
M.Sc., F.R.I.C., M.Inst.F.

EDITOR:
W. J. ROBERTS

A monthly journal covering the whole range of finishing operations for wood, metals, plastics, etc.

Published Monthly
by
ARROW PRESS LTD.,
157 Hagden Lane,
Watford, Herts.

Price 2/6d. per copy.
30/- per year, payable in advance, which includes FREE issue of the Industrial Finishing Year Book.

INDUSTRIAL FINISHING

(Incorporating "CORROSION")

FEBRUARY 1953

FEATURE ARTICLES

	Page
RETROGRESSION	465
PHOSPHATING IN PRINCIPLE AND PRACTICE	468
AUTOMATIC VITREOUS ENAMELLING	509
PROPERTIES OF ELECTRODEPOSITING NICKEL ...	512
ROLLERS ACCELERATE FINISHING	518

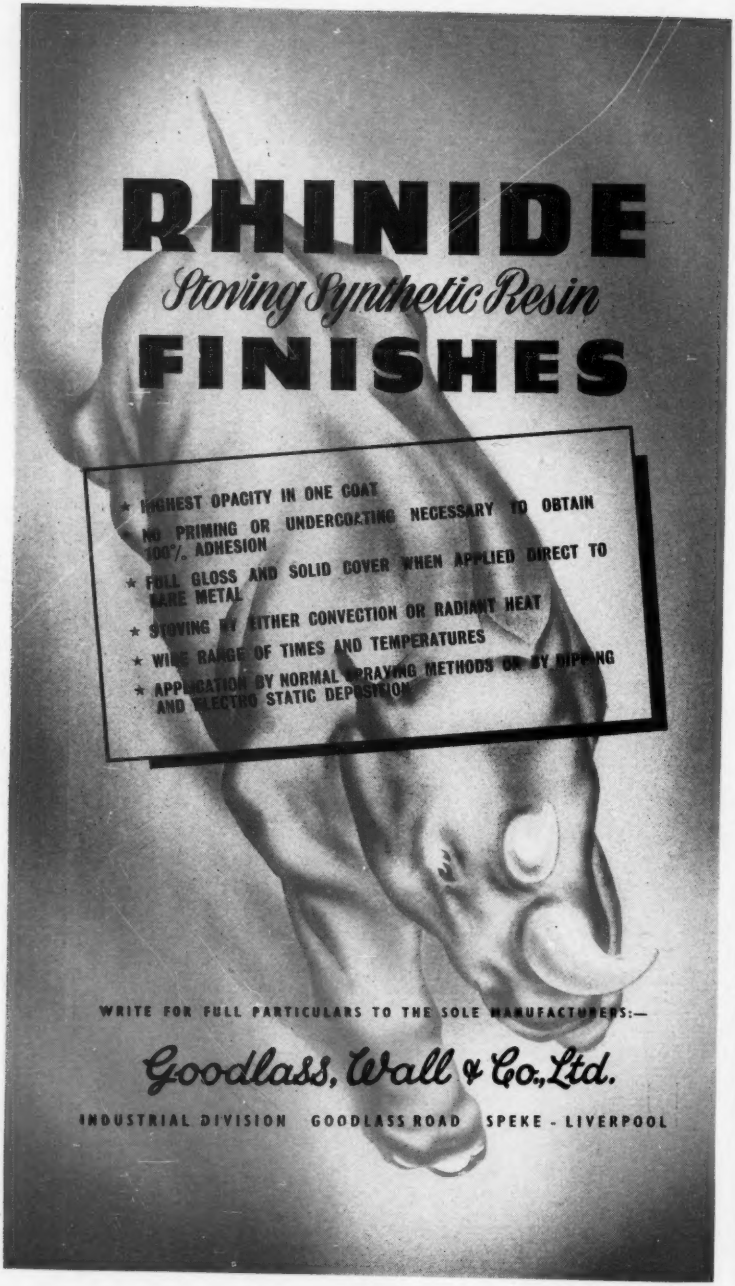
MISCELLANEOUS

PRACTICAL APPLICATIONS OF SYNTHETIC RESIN ENAMELS	492
DRY CLEAN AIR	494
EFFECT OF ATMOSPHERIC POLLUTION ON CORROSION	498
SPRAYED ALUMINIUM COATINGS	500
LEAD CYANAMIDE. DK825	502
TAILOR-MADE INFRA-RED	508
U.S.A. TRADE NEWS...	511
CORRESPONDENCE	516

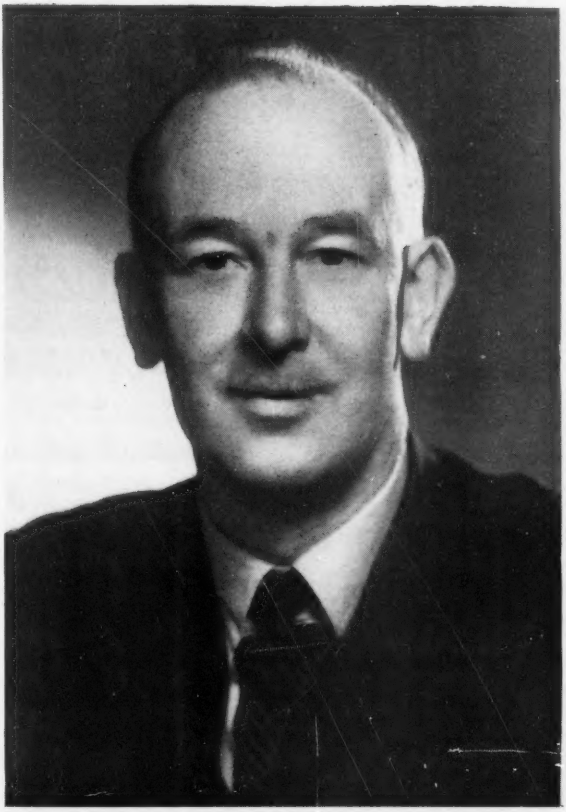
Copy and Blocks should be available to us by 20th of the preceding month.

They should be sent to:

INDUSTRIAL FINISHING
157 Hagden Lane, Watford, Herts.
Telephone: Gadebrook 2308/9


RHINIDE
Stoving Synthetic Resin
FINISHES
★ HIGHEST OPACITY IN ONE COAT
★ NO PRIMING OR UNDERCOATING NECESSARY TO OBTAIN 100% ADHESION
★ FULL GLOSS AND SOLID COVER WHEN APPLIED DIRECT TO BARE METAL
★ STOVING BY EITHER CONVECTION OR RADIANT HEAT
★ WIDE RANGE OF TIMES AND TEMPERATURES
★ APPLICATION BY NORMAL SPRAYING METHODS OR BY DIPPING AND ELECTRO STATIC DEPOSITION
WRITE FOR FULL PARTICULARS TO THE SOLE MANUFACTURERS:—
Goodlass, Wall & Co., Ltd.
INDUSTRIAL DIVISION GOODLASS ROAD SPEKE - LIVERPOOL

INDUSTRIAL FINISHING



W. J. ROBERTS

Editor: INDUSTRIAL FINISHING

Arrow Press Limited (Publishers of "Industrial Finishing," etc.)

W. J. ROBERTS.

Editor: "Industrial Finishing."

Jim Roberts, who has recently joined Arrow Press Ltd., and takes over the Editorship of "Industrial Finishing" with effect from February 2nd, 1953, is well known in technical and engineering journalism.

Born in 1907, he was educated in Liverpool and his early training included a special study of non-ferrous metallurgy, casting alloys, bearing metals and metallic corrosion. He is the author of a considerable amount of published work in this field and has for many years acted as a private consultant. He is a member of The Institute of Metals.

Before the war he had experience in the engineering divisions of several of the major oil companies including the Shell, Wakefield and Benzole groups. During this period he had responsibility for the installation and maintenance of storage and handling equipment, and co-operated with manufacturers of equipment in the development of finishes and protective coatings for outdoor equipment.

During the war he also spent a period in Iran with the engineering section of the Anglo-Iranian Oil Co. Ltd. Returning to this country in 1945 he became the editor of "Industrial Power and Production" which was, at that time, published by Metropolitan Press Agency. In 1946, he became the editor of "Mass Production," which post he held until January, 1953.

In 1948, feeling that his specialised experience in finishes and corrosion problems could be put to practical use, he became the Founder Editor of "Product Finishing," in addition to editing "Mass Production." He continued this dual editorship until his resignation in January, 1953. He subsequently joined Arrow Press. As a result, "Industrial Finishing" will have the benefit of the conjoint experience of both Dr. W. F. Coxon, who edited the journal from its inception and remains as Editorial Director, and Mr. W. F. Roberts.

Mr. Roberts is a Member of the Metal Finishing Association, Member of the Institute of Metal Finishing, Member of the Institute of Metals and a Member of the Institute of Journalists.

Industrial Finishing

VOL. 5 FEBRUARY, 1953 NO. 56

Retrogression

THE Anglo-American Council on Productivity have just issued a report on machine tool finishes, and in a nutshell they have suggested that it would be a good idea if the British manufacturers of machine tools considered again the "war-time finish." It will be recalled that Lieut.-Gen. Sir Thomas Hutton, K.C.I.E., C.B., M.C., general manager of the now defunct Anglo-American Council on Productivity and general manager of the new British Council on Productivity, has been the guest at two functions organised by the Institute of Metal Finishing, firstly their annual conference, and secondly, their recent banquet in Birmingham. On both occasions he stressed the desirability of the Institute working closely together with his new British Council on Productivity.

It would seem that in his digressions aside to the various finishing experts he was not altogether favourably converted to the importance of finishing—or at least, if he was so converted he was unable to talk fast enough to the machine tool Anglo-American Productivity team!

Maybe a suspicious mind is not altogether a good thing, but in the last few years Britain has built up a healthy export trade in machine tools to the tune of something like £20 million per annum. This was new business, for pre-war it was nothing like this in extent. The Americans are noted for high-pressure salesmanship, and to this extent one offers them full marks in persuading the British Productivity Team to put forward this retrogressive measure of abandoning the necessity of providing a good finish on machine tools. A war-time finish would kill the British export trade stone dead, and our American cousins would not altogether weep even crocodile tears in this respect.

Here, of course, one is preaching to the converted in so far as the finishing engineer is concerned, but because INDUSTRIAL FINISHING is read not only by the finishing engineer but by management in a variety of industries, literally from motor-cars to tintacks, it is thought worth while recording a few points against this retrogressive measure.

Firstly, a machine tool is valuable piece of equipment. If it looks good, is well-designed, has a streamlined appearance and will last a useful life, it is a worthy acquisition. The finish determines, largely, the interest by the operative; the amount of care he will take of the machine in use and the quality of the work which the machine will undertake. The more attention he gives to the machine in the way of cleaning and maintenance, the longer it will last. To spend a large amount of money upon the relatively costly machine and literally spoil the ship for a ha'porth of tar as far as the finish is concerned is one of the most damning recommendations which has yet emanated from the American Council. It is often overlooked that the quality of a finish is determined by, firstly, the amount of effort which is put into the cleaning and pretreatment process, and secondly, to the quality of the finishing materials. If one assesses the cost of proper pretreatment against the cost of finishing materials as being in the order of about three or four to one, one is not far short. Therefore, skimping the finishing means skimping the pretreatment, or reducing the quality of the finishing materials used. In both cases it means that the equipment is liable to rust and corrosion, and even a lathe which hums mechanically to perfection but is covered with rust blotches in the early stages of its life is never looked upon as being a prized possession of its owner.

The person walking round the factory sees the rust marks and overlooks the performance. The potential buyer in the showroom sees a dull, unattractive finish, which automatically relegates the article in his mind. The importance of "finish" is overlooked by many, and the fact that it is overlooked by a representative team such as that chosen to investigate machine tools stresses how often it is forgotten that the finish of an article not only makes the article attractive but protects it. A machine crystallises the efforts of a score or more skilled technicians, of maybe hundreds of thousands of pounds put in on the prototype, of heavy tool costs for production, and yet it is seriously suggested that price reductions should be maintained at the expense of the appearance and durability of the article. This is indeed a retrogressive suggestion, and the Institute of Metal Finishing would do well to take it up with the general manager of the Anglo-American Productivity Council as soon as possible.

Maybe a quotation from a talk given by Dr. W. F. Coxon on the B.B.C. "Question of the Hour" programme on 3rd March, 1949, is worth repeating again:

"How important is finishing? Well, Sir Charles Goodeve, Director of the British Iron and Steel Research Association, has said:

" 'Britain has built up a reputation for high quality and good workmanship. This reputation may often depend on satisfactory finishing, because an article is judged by its finish.

" 'A reputation takes many years to build. It can be destroyed in a few weeks by bad workmanship. If badly finished articles are exported, we shall undoubtedly lose our foreign markets.'

"A good finish arouses our immediate interest in whatever the article may be, but, likewise, a bad one causes instant revulsion.

"And so it is that finishing is of prime importance, both to stimulate home sales and to maintain an export drive, so vital to our national interests.

"I have dwelt on the importance of finish as an attraction, as something which arouses interest. That is the æsthetic appeal, if you like, of the finishing process. But there is another side to it—finishing, besides making an article attractive, must also protect it.

"Steel must be protected from the ravages of rust, the corrosion of sea water or the atmosphere, and wood must be prevented from rotting. That is done by the finish.

"And so it is that we have this d o u b l e importance of finishing. Firstly, it stimulates interest—it makes us curious—it makes us want to look further into the merits of an article. And, secondly, it lengthens the life of the article—it gives it durability. Aesthetic appeal and durability, then, are the important qualities of the finishing process.

"Thoughtful designers now realise that finishing means more than just a coat of paint. In the past, thousands of pounds were spent in the technique of manufacture, whilst the finishing

shop was often looked upon as the Cinderella of the show. That changed during the war, and I will quote just one example to show how that change came about. In the early days of the Burmese campaign only one article in twelve sent to our forces survived to be used on the spot. Bad finishing and inadequate packaging destroyed them on their way to the front.

"There were fungus growths which short-circuited radio sets. Other fungi rotted packing cases and tents. Moulds crept over leather goods and made them hard and shapeless. White ants bored into the stocks of rifles, so that the wood crumbled away. Not even glass was safe in the Burmese jungle. Bacteria formed on optical instruments obscuring the lenses and prisms. Step by step we had to overcome each new difficulty as it arose. Various fungicides were incorporated in the paints. Special chemical dips were given to the wood, special finishes were given to the interior of radio sets and to the glass in optical instruments. Perhaps this lesson, learned the hard way, did more than anything else to make British industry 'finishing conscious' from the viewpoint of durability.

"British industry is now discovering the second function of industrial finishing—making goods attractive. Exports mean much to us today. The world is no longer a sellers' market where goods can sell irrespective of appearance and quality.

"The overseas customer has become very discriminating. He knows that British-made goods are mechanically as perfect as any he can get. But he is no longer content just with that. He demands modern lines and, above all, a high quality finish—a finish which looks good *and* lasts well."

That was three years ago—and a responsible team of technicians is unwittingly trying to turn back the clock!

Notes on the Inaugural Conference of the Institute of Metal Finishing, Organic Section, are given on another page. The new Organic Section can stimulate interest in the importance of finishing and so help to stem any retrogressive tendencies such as have been mentioned in regard to machine tools.

INDUSTRIAL FINISHING LUNCHEON CLUB

THE Club secretary has received the following note from Dr. Barnardo's Homes:

"I have been delighted to learn of the very welcome gift of £50 which you were good enough to send us once again from the members of the Industrial Finishing Luncheon Club. My official receipt has already been forwarded to you but I feel that I must send you this personal line to let you know how grateful I am to you and to the members, for your kindness in having remembered the needs of our children once again.

"It is most encouraging to receive your regular support in the work that we are doing."

L.C.C. EVENING COURSES IN SPRAY PAINTING FOR PAINTERS AND DECORATORS

THE Sixth course in spray painting will be held from Monday, 13th April, until Tuesday, 14th July, 1953. These courses are in two grades, elementary and intermediate, each of twelve weeks duration requiring an attendance of two evenings each week.

They are intended for craftsmen with adequate industrial experience who wish to broaden their knowledge and skill in this branch of the painting and decorating trade. Students who have already taken the elementary course may proceed to the intermediate course, subject to satisfactory progress being made. At the conclusion of each course, an examination is held and a report is issued on the work done.

Intending students should apply to the Secretary at the School for an enrolment card, which should be completed and returned as soon as possible.

The classes will be held on Mondays and Tuesdays from 6.30 to 8 p.m. in the Spray Painting Workshops of the L.C.C. Brixton School of Building Annexe (Building Trades Department) at 56/57 Barrington Road, Brixton, S.W.2. (Nearest Railway Station—East Brixton.)

Phosphating—In Principle and Practice

Imperial Chemical Industries Ltd., Conference

THE conference at the Midland Hotel, Birmingham, on 14th January, 1953, was preceded by a luncheon at which the chair was taken by MR. E. W. PLOWMAN, development director, I.C.I. Paints Division.

After welcoming the gathering he said that his company could perform a very useful service to industry in providing the platform for discussion of problems of mutual interest in those industries which were concerned with the finishing of metals in a very general sense. The particular subject on this occasion was the pre-treatment of metals by phosphating and allied processes.

"It is hoped," he continued, "that the matter will be dealt with on a general basis, and that we can all avoid the error of using various forms of "ising."

THE CHAIRMAN then introduced the lunch-time speaker, Mr. Silman, saying: "I am sure that Mr. Silman needs no introduction from me to you. He is not only the President of the recently-formed Institute of Metal Finishing, but he is also an authority on the subject of metal finishing in its broadest sense."

MR. H. SILMAN, President, Institute of Metal Finishing, said that the attitude that an Institute or an organisation engaged in the dissemination of information should not in any way concern itself with proprietary processes was to shut it off from one of the most prolific sources of data and information.

"Let us see what we acquire when we purchase proprietary processes," he continued. "Surely we can make this ourselves and save a lot of money. The difference in the cost is the cost of the ingredients as compared with the cost of the product as we buy it.

"I have gone into the cost of purchasing the ethical proprietaries, and I have found that their costs are very reasonable and worth while. You purchase technical service by experts who are at your disposal at all times. You also purchase the continued research and development of these processes, both in this country and, very often, in countries abroad."

The first paper, by Mr. A. W. Put-

MR. E. W. PLOWMAN

MR. H. SILMAN

nam,* dealt with plant requirements, and Mr. Putnam said that the majority of phosphating processes comprise a cleaning operation followed by phosphating and finishing.

A typical schedule for a phosphating process as a preparation for painting consists of seven stages; alkali or emulsion cleaning, two water rinses, phosphating, water rinse, acid rinse, drying. Where the output and form of goods are suitable, the first three stages can be replaced by solvent cleaning.

The simplest sort of plant consists of a series of tanks, one for each stage of the process, in which the goods are successively dipped for the required time either singly or in batches. The goods may be transferred from tank to tank by a simple lifting block carried by an overhead joist, or, a little more elaborately, by a power hoist running along the row of tanks on an overhead runway.

A process for tubular lighting fittings consists of a hot caustic degreasing, a hot water rinse, a phosphoric acid deruster, a cold water rinse, the phosphating, a cold water rinse, and a final hot rinse.

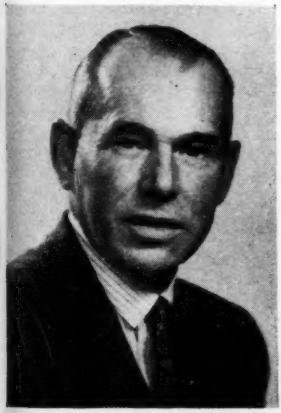
Large numbers of small objects, such as bolts and nuts, may be processed in such tanks by placing them in baskets or perforated drums which are immersed in the solutions and which may be mechanically rotated. They may also be passed from tank to tank by means of baskets which dip from one station into another. This practice is common where the heavier types of phosphate coating, produced in iron-manganese phosphate solutions, are applied.

When goods of large size, such as sheet metal panels or pressings, are phosphated, it is usually as a preparation for painting. For this purpose lighter and smoother phosphate coatings are required than for pure rust-proofing, and these need shorter immersion times in the phosphate solution. Continuous plants are, therefore, possible within a reasonable length. However, the conveyorised immersion plant has become less usual since the introduction of the spray-phosphating process, but it is still required in certain cases.

Spray-Phosphating

In the spray-phosphating process, the goods are treated by spraying them with the various solutions in turn instead of by immersing them in solutions. Spraying cuts down the length of the plant for a given output, and simplifies the arrangement of the conveyor which does not have to lower and raise the goods into and out of the tanks, but only needs to carry them along a straight, horizontal line. Components from small steel pressings to complete motor car bodies are dealt with in this way.

* *Carrier Engineering Co. Ltd.*



MR. H. NIELSON (Chairman)

MR. A. W. PUTNAM

A spray-phosphating plant may consist of various stages, cleaning rinse, rinse, phosphating, rinse, acid rinse and drying. Each of those stages has its own tank from which the solution or water, as the case may be, is taken by the pump and discharged into a system of vertical pipe heaters carrying nozzles. These nozzles spray the solutions on to the goods from both sides. Meanwhile, the goods, while being processed, proceed inside the sheet metal casing or tunnel, that tunnel being obviously necessary to contain the spray, the mist and the steam generated. The space in between the various stages will be determined largely by the avoidance of splashing from one stage into another, and in any case will be minimised to get the goods from one stage to another as quickly as possible. The tanks are usually, as shown in the diagram, extended beyond the confines of the casing, and under the exposed lid or the exposed top, the heating devices and strainers are placed for easy access. On the side remote from the pump will be the straining devices. The solutions are drawn off by the pump over the coils and heated and jetted by a nozzle over the goods. In between each stage there will be, about centre line, a silhouette cut as closely as possible to the profile of the goods through which the goods will pass from stage to stage.

Thorough coverage is essential, and both sprays and goods must be disposed so that the goods are completely covered over every part.

An interesting and important post-war development is the "Rotodip" plant, which has been applied to the continuous phosphating, and painting, of complete motor-car bodies, to which it is particularly well adapted.*

Which Plant?

Generally it will be the paint manufacturers business to decide which of these forms of plant best suits each application. Let us consider one or two examples. It is required, for instance, to give a rustproof finish to a fairly large output of small steel components. This may be done by treatment with iron-manganese phosphate. These solutions are not suitable for spraying, so the phosphating has to be by immersion. The immersion time is relatively long, perhaps some 30 min., so that a continuous conveyorised plant would be unwieldy, expensive and unjustified. This type of process is, therefore, carried out by successive immersion in a number of static tanks and the method of transporting the goods from tank to tank will be decided from the usual considerations, such as the number and weight of pieces.

In other cases the choice of plant is not so clear-cut. Sometimes more than one alternative type of plant has to be worked out in some detail before the decision can be made. Suppose it is required to phosphate sheet metal pressings or panels as a preparation for painting. For this purpose phosphating solutions can be formulated either for immersion or for spraying. It must first be decided whether the output of goods is sufficient to justify a continuous conveyorised plant. If it does not, an immersion plant will be used. If it does, a spray plant will usually be decided on because spray phosphating takes less time than dip phosphating and, in a conveyorised plant, to cut down time is to cut down conveyor and plant length. However, this is not always the only consideration. In the spray process, the goods, in their passage through the plant, must be disposed so that all surfaces to be treated are directly accessible to the spray. One piece must not shield another. This means that the goods must be conveyed through the plant in single file. But there are some classes of goods, for example, large flat sheets or smaller pressings in larger quantities, where the output may be such that they can best be conveyed, for a reasonable plant length, by being disposed several abreast, even dozens abreast, on a crossbar conveyor. Goods so arranged cannot be properly sprayed. They must be dipped. The plant manufacturer must often in such cases examine the proposition both ways—the quicker moving monorail conveyor with a shorter spray processing time, and the slower moving crossbar conveyor with a longer dip processing time—to find which best fits the user's space and pocket.

* *See* INDUSTRIAL FINISHING, *April*, 1949, *p.* 533—*"Rotodip—a New Approach to Motor-Car Finishing."*

For all usual applications each successive stage of the process will require a tank, either to dip the goods in, or, in the case of a spray plant, to hold the solution being sprayed. Tanks are usually made in heavy mild steel plate, of $\frac{3}{16}$in. or $\frac{1}{4}$ in., of welded construction, and the phosphating tank itself is often, though not always, rubber lined or made in stainless steel. The decision which to use is a matter of expediency. Smallish tanks which can be replaced without difficulty could be made in mild steel. Tanks which are built into a continuous plant and which would be more difficult to replace would have to be constructed for longer life. Most tanks, depending on the process schedule, will be heated and their design must allow for the accommodation of coils or other heating devices. They must also allow for the accumulation of sludge which is deposited in most tanks, particularly the phosphating tank. The goods in their passage through the tanks must not touch or disturb this sludge.

Spray-phosphating plants have relatively small tanks since the goods do not have to go in them and all that is required for each stage is a tank to which the sprayed solutions will drain back, from which the spray pump will draw, and which will contain the heating devices. It is, therefore, possible to arrange these tanks partly outside the confines of the processing casing proper for access. The tunnel through which the goods are conveyed and in which they are sprayed is cased in with sheet metal to contain the spray and the vapour generated. These cases will generally be made of $\frac{1}{8}$ in. or $\frac{1}{16}$ in. plate.

Heating

Most of the tanks in a phosphating plant contain solutions or rinse waters which need to be heated. Heating may be by means of any of the usual heating media. The use of electricity has not come within my own experience and I imagine that it would need special precautions, such as an outer jacket. Gas can be used, but here again there are limitations; the phosphating tank could not be rubber-lined and should be made in stainless steel or in heavy mild steel. The heating should not be directed on to the flat bottom of the tank, which is usual in gas heating, where the deposited sludge must be allowed to remain undisturbed. It may be directed on to sloping sides or applied through heating tubes.

The commonest method of heating, at any rate for all but the smallest plants, is by steam or high-pressure hot water inside pipe coils. These coils can be of heavy gauge mild steel tubing; in the phosphating tank, for which rubber lining or other protection is recommended, it may seem inconsistent to use ordinary mild steel heating coils. It is true that their life is limited, perhaps to two or three years, because it would be impracticable to rubber-cover them as that would fairly effectively insulate them as heat emitters. Copper coils were at one time largely used, but they do not stand up as well mechanically to descaling as do mild steel coils and, at least in the experience of some, their life was not substantially longer than that of mild steel coils, nor did they collect less scale. Stainless steel is expensive and difficult to come by and several mild steel coils can be bought and scrapped for the cost of one stainless one. Mild steel is, therefore most generally used for the phosphating tank and it is, of course, perfectly satisfactory for the cleaner and rinse tanks.

Heating coils should be installed so that they can be easily removed for descaling from time to time. The scale can usually be got off fairly readily by the use of a light hammer. If a 2-lb. hammer is effective, it does not follow that a 7-lb. one will be proportionately more so. In a recent case within my experience, the heating coils of a phosphating tank were found to be perforated by corrosion after about a year's use or less. On examination of the metal it was concluded that what had taken place was "fatigue-corrosion," due to coils having been vigorously belaboured with a heavy hammer in descaling. I must be careful to point out that I am not giving this opinion on the cause of the corrosion as my own, for I should be quite unable to sustain any argument on metallurgy. I am quoting the opinion given in a report on the case by the chief metallurgist of a leading insurance company.

When the coils are working with a coating of scale, this does not, of course, directly increase the quantity of heat required to run the tank, though it is a not uncommon belief that it does. What it does do is to devalue the coil as an emitter of heat so that it is neccessary that the coil be installed in the first place large enough to allow for this loss of effectiveness. At the same time, it is not a solution to put in coils which are very large indeed on the assumption that they will allow you to operate so much longer between descaling, because when you do have to descale these enormous coils they are such a job to get at for that purpose that it is usually felt more advantageous to descale half-sized ones twice as often. Heating coils should not be installed on the bottom of tanks which must be left free for the undisturbed depositions of sludge. They should be installed vertically at one or more of the sides.

Steam Heating

If the heating medium is steam, it is possible to consider heating some of the tanks by direct injection. In this form of heating, the steam, having condensed in doing its job, will accumulate in the tanks and will eventually cause them to overflow. This does not matter in the case of the heated rinses but it cannot be allowed in the phosphating tank where it would result in valuable chemicals being put down the drain. The phosphating tank must, with steam, be coil-heated. Alkali or emulsion cleaner tanks could be injection-heated as these baths have to be skimmed and changed periodically and the overflow would not greatly matter, provided that the chemical composition is maintained.

The temperatures of the various heated tanks should be shown by suitable thermometers. The temperatures of cleaner and phosphating tanks at least should be automatically controlled on a plant of any size, and on all continuous plants. A simple and inexpensive thermostatic system, of the self-contained or self-acting type —by that I mean one where the valve is opened and closed by vapour or liquid pressure from a bulb immersed in the tank—is all that is required. Of course, for small plants of the dip type directly and continuously under the eye of the operator, automatic temperature control is frequently omitted. Each case can be judged on its merits.

In spray-type plants spray nozzles are used which break up and atomise the solutions and direct them quite forcibly on to the goods. A typical spraying pressure is 10 to 15 lb. per sq. in. The nozzles, spray piping and pump handling the phosphating solution should be of stainless steel. I say "should be," but, particularly in past years, stainless steel has been considered so expensive and difficult to get that many of these systems have been equipped with mild steel piping, with the knowledge that they will have to be renewed fairly soon.

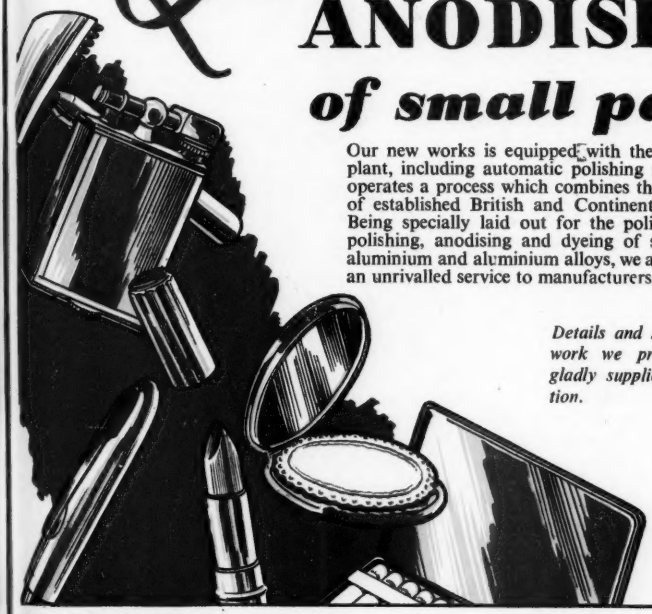
Conveyors for continuous plants are installed in accordance with usual conveyor practice and call for no special mention. They should be protected so far as possible from contact with the processing solutions. Under the heading of conveyors it seems convenient to mention a point which is important for the success of the phosphating process. In the process schedule which the supplier of the chemicals draws up, it will be implicitly understood that the goods are transferred from one stage of the process to the next without delay.

The "Recommendations for Phosphate Coating as a Basis for Painting Steel" issued by the B.S.I. include this point. They say, "It should be emphasised that the best results can only be achieved when the whole process is operated with the minimum practicable delay between its component stages, degreasing, phosphating, rinsings, drying-off and painting."

One reason is, of course, that oxidation between stages must be avoided. Another is that the chemical used in each stage must be removed before proceeding to the next stage. After cleaning with hot alkali or emulsion, the goods, when withdrawn, will tend to dry owing to the residual heat in the metal. If the film of cleaning solution dries on the goods, it appears likely that it will be more difficult to remove it completely in the rinsing. The same applies at withdrawal from the phosphating stage.

In simple plants, with static tanks

Quality ANODISING of small parts



Our new works is equipped with the most modern plant, including automatic polishing machines, and operates a process which combines the best features of established British and Continental techniques. Being specially laid out for the polishing, electro-polishing, anodising and dyeing of small parts in aluminium and aluminium alloys, we are able to offer an unrivalled service to manufacturers.

Details and samples of the work we produce will be gladly supplied on application.

A.I.D. approved

Phone HOWARD 2908

Scrib Ltd.

METAL SECTION, LOCKFIELD AVENUE, BRIMSDOWN, MIDDLESEX

Manufacturers' samples gladly processed without obligation

and hand transference, this point is one which the user should be aware of and should act upon. In continuous plants it is a matter for the plant manufacturer to deal with in his design. In some plants the goods are sprayed with water while in transit from stage to stage to avoid this drying-off. This may be necessary in some cases but not in others. The time which elapses between each stage will be determined by the conveyor speed, which is a function of the quantity of goods to be dealt with, and it will also be determined by the minimum length between the stages required to avoid splashing from one stage to another. Therefore, if the period between leaving one stage and arriving at the next is prolonged, then it is considered advisable to spray with water between the stages to keep them wet. Incidentally, this water is not wasted because in nearly every case it will be required to make up the evaporation from the process tanks themselves.

Another factor which has to be considered in the design of the plant is that of the steam coming from the hot solutions, particularly in a spray-type plant. In a simple plant consisting of a series of static dip tanks this presents no great problem. If there is any problem here it is that of avoiding nuisance in the shop, and it can be dealt with usually by transportable tank covers or by simple extract headers. In continuous plants, particularly those of the spray type, other considerations are also involved.

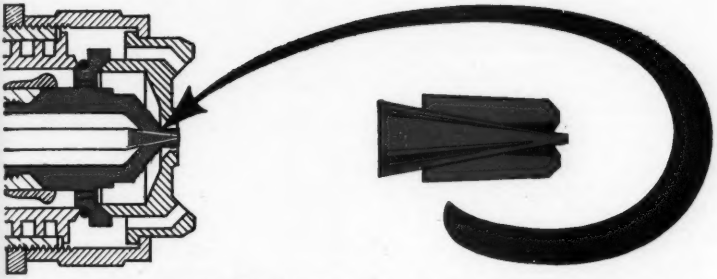
The condensed vapours and spray mists—I can only describe it that way because it is not steam but visible droplets of water and solutions with which we are concerned—given off in each stage will contain traces of chemicals of that stage and have to be removed so that they do not con-contaminate the goods in other stages since they are all generated and contained within one tunnel. The manner in which the steam and mists are removed has, therefore, to be properly considered by the plant designer, and the steam removal system must be kept in proper working order by the user.

The final operation in the phosphating process is drying-off preparatory to painting or oiling or other finishing. The drying ovens may be of any type suitable to the size and nature of the plant and have no features peculiar to the phosphating process. It goes without saying that the goods must be thoroughly dried before painting or oiling.

Passage Through Plant

Now a word about the arrangement of goods when passing them through the phosphating plant. Although it is necessary to transfer the goods from one stage to the next with the minimum delay, it is, of course, essential that on removal from each stage they be thoroughly drained. The various solutions are kept separate, each in its own tank, and each has its distinct function to perform. They must not be mixed. Yet it is not often realised how easy it is, especially with a continuous plant, for the goods themselves to act as a conveyor of solutions, to pick up the cleaner solution and pour it in the following rinse tank and so on throughout the plant. The goods must be carried through a phosphating plant of any sort in such an attitude as to be self-draining, and if the form of the goods does not give any such position, then draining holes must be provided in them. If this is not properly arranged, the various baths will became contaminated, and the processing will soon become unsatisfactory. This is a matter of great importance and requires the full understanding and co-operation of the user.

It has been mentioned that in the phosphating action a certain amount of sludge is formed. This varies greatly in amount and depends, among other things, on the type of phosphating solution, on the throughput of goods, on the working hours of the plant and on the phosphating solution temperature called for by the processing schedule. In the simple plant consisting of a number of still dip tanks there is no difficulty in removing this sludge at intervals by hand, but large continuous plants usually have some organised method of dealing with it. Usually, a proportion of the phosphate solution is pumped up, after working hours, into a settling tank where it is allowed to remain until the beginning of the next day. The clear solution is then returned to the process tank. At intervals the separated sludge is withdrawn from the bottom of the settling tank and dumped. I



abrasive materials spelt ruin to spray guns

—until DEVILBISS · AEROGRAPH introduced

NITRA-ALLOY

NOZZLES AND NEEDLE TIPS

With highly abrasive finishing materials, it is the nozzle and needle-tips that take the punishment. DeVilbiss · Aerograph supplied the answer — Nitra-Alloy, which greatly increases the life of guns used for spraying vitreous enamelling etc. On all spray equipment, you keep that extra jump ahead that means really competitive production, if you standardise DeVilbiss · Aerograph spray guns and ancillaries. Write for the full descriptive catalogue. 21J.

TYPE JGA
—heavy-duty high speed gun for quality finishing with all types of material.

TYPE DCA
—particularly suitable for spraying small quantities of heavy materials at low pressure.

TYPE VFS
—an easy-to-handle gravity-feed gun, specially designed for producing mottled effects.

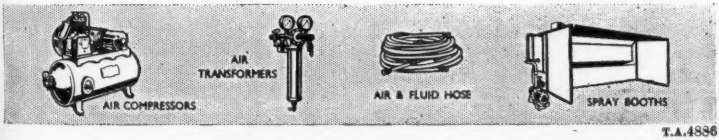
Spray Equipment for vitreous enamelling

DEVILBISS
AEROGRAPH

Sets the pace in spraying

The SYMBOL of SERVICE

The Aerograph Co. Ltd., Lower Sydenham, London, S.E.26. Tel: Sydenham 6060 (8 lines)



T.A.4886

do not wish to give the impression that this will deal with the whole of the sludge as it is formed, but it will somewhat reduce the frequency with which the phosphating tank has to be cleaned out. It has been proposed to remove sludge continuously from large phosphating tanks by withdrawing, centrifuging and returning a quantity of the solution while the plant is working, but this method is still in the experimental stage.

Maintenance

Now a word on maintenance. All engineering plant requires maintenance. Phosphating plant represents money spent with the object of improving the quality and durability of the product. This money, and the floorspace occupied, will have been wasted if the user goes through the motions of passing the goods through the plant, but does not keep the plant in a condition to process the goods properly. The maintenance of a phosphating plant is not difficult or troublesome but it is extremely important. It falls into two parts, the chemical maintenance and control of the solutions, and the physical maintenance of the plant. I must say a few words only about the latter.

The real point is that the plant must be kept clean in the sense that the solutions and their tanks should be kept uncontaminated, the spraying piping and nozzles unobstructed, the heating coils descaled and so forth. Water rinses should be continuously overflowed while in use and discarded frequently, say every other day. Some people replenish them every day; others not so often as every day. It should be remembered that water is one of the cheapest running costs, amounting probably to not more than 5 per cent. of the cost of the chemicals consumed.

The phosphating solution itself is not discarded. The phosphating tank is emptied by pumping the solution into an adjacent rinse tank or tanks and then cleaning out the sludge and dumping it, after which the solution is returned to its tank. A rubber-lined phosphating tank needs to be cleaned with reasonable care. The spraying systems, including pipes and nozzles, must be kept unobstructed. All nozzles must be in their original position and attitude to preserve the spray pattern and coverage.

I do not wish to make heavy weather of this question of maintenance. For the great majority of phosphating plants it consists of a number of comparatively simple and commonsense operations, but it is important that the user should understand the necessity of carrying them out, and carrying them out regularly and in time.

Doubtless, most of those present will expect to hear something said about the cost of phosphating. In a treatment of phosphating as general as is the present one, the question of costs can only be dealt with very broadly and we must fall back on that rather vague conception, the average case. However, here are some examples of chemical costs.

The highest chemical cost is naturally that of the process where the heaviest phosphate coatings are applied, to be oiled to give a rustproof finish without painting or for coating friction surfaces and so on. This may come out at about 20s. per 1,000 sq. ft. of surface treated.

The phosphating process used as a preparation for painting, which is usually based on zinc phosphate solutions, produces a thinner and smoother coating. This may come out at 5s. to 8s. per 1,000 sq. ft. treated. One specific case which I worked out for this purpose came to 5s. 6d. per 1,000 sq. ft. The iron phosphate process, which gives a very thin and smooth coating as a preparation for the painting schedule on certain classes of goods, and which is less generally applicable than the last process mentioned, comes to between 2s. and 3s. 6d. per 1,000 sq. ft. of treated surface.

These are all chemical costs; that is to say, the costs of the chemicals used in cleaning, phosphating and finishing operations but not, of course, including the final finish such as painting or oiling.

In one or two cases which I have examined, the cost of services, that is, power, water, tank and oven heat, proved to be about half the cost of the chemicals, but there must be wide differences between the various types of plant, and I do not think this could be taken as a general statement.

DISCUSSION

LIEUT.-COL. D. McFARLANE (Heat and Air Systems Ltd.): My question is in three parts. First, what is the reaction of the user to the size of the plant which is required; second, what is the reaction of the user to the maintenance of the plant; and third, what is the reaction of the user to the need frequently to replace parts of the plant?

MR. PUTNAM: I have no specific information about the reaction of the user to the size of the plant. It is usually found that if a user has decided that he wants to phosphate and the plant manufacturer has decided that he can do it in the minimum space which the user allows, there is no objection. From my experience, I know of no objection on the part of the user to the space which is required.

There are many more reactions on the part of users in relation to maintenance. I have taken the opinions of several users known to me, and I can only say that I have been surprised at the small amount of complaint which they make about the maintenance required by their plants. They regard the maintenance as a matter of their normal routine.

MR. C. L. HUTTON (Metropolitan-Cammell Carriage and Wagon Co. Ltd.): Is there any alternative to spraying or dipping? Is there an application which would apply to such things as railway coaches where the paintwork is applied to the completed coach?

MR. PUTNAM: I take it that you are referring to goods which are so bulky as not to be amenable to either dipping or spraying. I have purposely made no reference to this. Although there are processes, they do not really involve any plant as such. They are processes where the goods can be sprayed with a spray gun or where the phosphating agent may be in the form of a paste or something like that.

MR. W. ANDREWS (Times Review of Industry): Taking a broad survey over what Mr. Putnam has said, should we be right in thinking that, generally, the most suitable material is mild steel and that in exceptional cases stainless steel may be more suitable, but usually does not pay? Secondly, I should be grateful if Mr. Putnam would elaborate his statement that iron and manganese phosphates are not generally suitable for spraying.

MR. PUTNAM: I think there is little doubt that if questions of cost and availability had not to be considered we should make a larger proportion of these plants in stainless steel. But experience shows that it would not really be justified.

One thing which I did not mention, which I should have done perhaps, is that the tanks and casings, particularly on continuous plants, should be made in heavy mild steel, probably of $\frac{1}{4}$ in. or $\frac{3}{16}$ in., and they should be properly painted with a suitable paint on installation.

The question of the unsuitability of iron and manganese phosphates for spraying is really a chemical one. I made my statement about that because as far as I can remember I have never met sprays of those materials.

MR. P. M. MARTIN (Richard Thomas and Baldwins Ltd.): I am at the moment concerned in the design of a plant for the continuous phosphate coating of strip. I gained the impression from Mr. Putnam that you get a greater output for a given length with spray phosphating equipment than with immersion equipment. Would that be the case with strip phosphating?

Mr. Putnam does not seem to think much of the possibilities of electric immersion heating. I should like to know why, and what is his objection to electrical immersion heating. If the heaters were not made of stainless steel, would there be any other objections?

We have been considering the continuous removal of part of our phosphating liquid and attempting to deposit the sludge in a second tank. I should like to have Mr. Putnam's views on that. Or would he consider that centrifuging would be more effective?

MR. PUTNAM: With regard to the first question, I hope I did not give the general impression that a spray phosphating plant was necessarily better than a dip phosphating plant. I tried to point out that it depends on what you are trying to phosphate and that in many cases there was so little to choose that the manufacturer had to go a long way in examining both the dip and the spray applications to find which would be the more useful and the more compact. The times with spray phosphating are shorter than those with dip phosphating, but with spray phosphating you are limited by the fact that you must expose all your goods completely to the spray and you cannot bunch them.

If you want to bunch the goods you can put many more pieces per foot length of conveyor and greatly shorten the conveyor, but then you cannot spray and must dip.

MR. MARTIN: In the case of strip, is it very easy to ensure complete coverage?

MR. PUTNAM: Yes. It is really a mechanical question. It depends on how you can dispose of your goods in the physical sense, and how you can carry the goods in order to give you the shortest plant length.

I am sorry if I gave a wrong impression about the electrical immersion method. What I said was that I had had no personal experience of using it and I imagined that if I were asked to use it my first reaction would be to jacket the process tank and put the electric immersion element in the jacket; but for all I know there may be a number of plants working which have the immersion elements directly inserted in the solutions, although that is not my experience.

Sludge removal is a very thorny question. Two methods have so far been tried. One is periodically to pump up a portion of the phosphating solution into a settling tank—it is difficult to pump the whole owing to space problems—and, having allowed it to settle, to decant the clear solution back and to withdraw the sludge from the bottom of the tank and then dump it. The other method which has been tried is centrifuging, and that is a very effective method of getting the sludge out.

THE CHAIRMAN: I am not quite sure in my own mind whether Mr. Martin's first question has been answered. It might be of general interest to all of us if Mr. Putnam would explain why the spray process should be quicker than the immersion process.

MR. PUTNAM: That is a chemical matter. By immersing steel, for example, in a suitable dip phosphating solution the reaction will be completed in a matter of five or six minutes. That time is required for the completion of the conversion. On the other hand, if you have a spray plant in which the solution is suitably formulated for spraying and is sprayed on the goods, it is a fact, for which I cannot give the reason, that the conversion of the surface is satisfactorily completed in one to two minutes.

MR. C. NICHOLAS (Metropolitan-Cammell Carriage and Wagon Co. Ltd.): My experience has been that it is not the steel tank for phosphating and chemical rust removing which suffers, but the electric arc welding at the corners. Is there any answer to it?

MR. PUTNAM: I do not think there is an alternative to welding. That is really a metallurgist's problem, and I have no doubt, speaking broadly as an engineer, that you get what the metallurgist would call an electrolytic effect due to the inclusion of foreign matters in the process of welding. I do not feel competent to expand on that, although I believe that would be the reason given for the trouble by those who know.

DR. S. WERNICK (The Institute of Metal Finishing): To return to the problem of sludging. There are two possible approaches, and I should like to know what has been done in either approach. The first is a chemical one. Are we "ising" folk doing anything in the way of trying to develop a solution which will either prevent sludging or very heavily diminish it?

On the chemical side, is it not possible in some way to do something with the solution so that the secondary and tertiary phosphates which are formed and whose primary objective is to get to the work, shall, instead of precipitating, be kept in solution? It seems to me that there might be some method of developing a balance between the accelerators and the heavy phosphates so that sludging is either reduced to a minimum or possibly in the long run completely averted.

The other method is to deal with it when we have got it. Mr. Putnam has made reference to some experiments which have been carried out on centrifuging lines. I wonder whether that is the best approach. That rather accepts the fact that one has to deal with the bulk of sludge material at a given time. Would it be possible to remove the sludge, so to speak, as it is formed? Would it be too much to suggest that some method of continuous filtration might be employed?

MR. PUTNAM: Dr. Wernick's first question was whether the manufacturers of the various "ising" chemicals are doing anything to minimise or eliminate the formation of this sludge. I am not in possession of any particular information, and I do not think that I, as a representative of the plant maker, am in a position to answer that.

Filters have not been used so far as I know. I think they might be used. I am not clear at the moment whether they would be applicable to dip plants, but in the case of the spray-type plants there would seem to be a distinct possibility, because you could withdraw the solution from the tank and discharge it through a filter, and the clean solution would then be sprayed on the goods, so that the goods would be on the clean side of the filter. This matter is being considered.

DR. S. G. CLARKE (Ministry of Supply): Mr. Putnam has rightly made the point about the undesirability of allowing solutions to carry over from one section of a spray plant to another. Some of the worst cases of corrosion that I have seen have been due to the failure of sprays in one part of a plant in that they have not treated the work properly as it goes through.

In some of their bigger plants, has his firm ever considered or used the idea of some electrical warnings connected to each of the spray pumps at each of the

MICA

Micafine mica powders are now readily available for use in the compounding of paints and specialised industrial finishes.

★

Our mica powders give added protection against corrosion, and assist in preventing disintegration of surface coatings at elevated temperatures.

★ ★

Other important properties include their value as anti-settling agents where heavy pigments are present, and as additives to such metallic pigments as aluminium and bronze.

★ ★ ★

micafine

THE HALL-MARK OF PURITY IN WET-GROUND MICA-POWDER

Write for full details to:

MICAFINE LIMITED · RAYNESWAY · DERBY

Telephone: Derby 55981 (2 lines) **Telegrams: "Micafine, Derby"**

sections of the plant and brought to a central point so that immediately any interruption of spraying occurs it is flashed to an observer and immediate attention given to the failure?

MR. PUTNAM: The short answer to that question is "No." We have not done that, but I am not for a moment saying that we should not. I think it is a valuable contribution and it should be borne in mind.

MR. R. E. SHAW (Development Section, Paints Division, Imperial Chemical Industries Ltd.): One speaker asked what the chemical suppliers are doing about preventing sludge formation. We are concentrating a lot of effort on the problem, and it may be of interest that in one "Rotodip" plant we have so controlled the chemical that the sludge formation is now down to about ½ in. of sludge per 1,000,000 sq. ft. processed, which is no mean achievement. We believe that that approach is better than putting in a lot of apparatus for removing the sludge.

There is a further point concerning electrical heating. I have seen plants in the States with immersion heaters of a rather unusual type in use. They are so-called hairpin electric heaters; that is, low voltage high nickel-chrome rods which were on a time cycle of about 9 min. on and 1 min. off. They had been in operation for 18 months without any cleaning.

The normal immersion heater is an absolute menace. The build-up can almost be seen. You can watch it grow.

Another interesting aspect is something which I hoped that Mr. Prior, of A. Reyrolle and Co. Ltd., would mention. They have tried encasing a steel coil in a thin, mild steel jacket in the phosphating tank, and that has reduced the cleaning required. Cleaning used to be needed every fortnight, but I think it has not yet been cleaned out after three months. Is that so, Mr. Prior?

MR L. F. PRIOR (A. Reyrolle and Co. Ltd.): That is so. It has not yet been touched. We have hopes that we shall not need to touch it for another six months or more.

Performance and Control

by

R. J. BROWN*

THE main object of phosphating is to provide resistance to corrosion. The phosphate coating in itself does not retard corrosion; it is the basis for the application of a seal material such as oil, lacquer or paint. The porous crystalline nature of the phosphate film ensures adequate coverage of the surface to be protected with the barrier medium, and in the case of hard barrier coatings such as lacquers and paints, the infinitely improved contact which is achieved between the metal surface and the protective film prevents the spread of corrosion beneath the paint film should it become damaged in service.

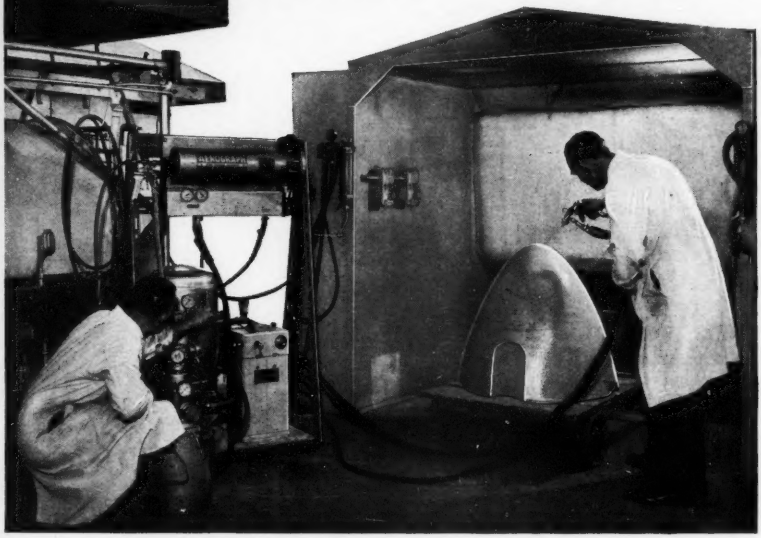
Increased Usage

There is no doubt that phosphating as a pre-treatment for painted assemblies is finding increased usage. In the pedal cycle industry it was used for the treatment of frames quite early in the century, and from such humble beginnings it has progressed to general use in the refrigerator industry, for office furniture and for domestic containers. In the motor

Mr. R. J. Brown

* *Nuffield Central Research Laboratories.*

HOT SPRAY PAINTING



How to Control the Finish—from the Start

The great advantages of Hot Spray painting are only just being realised. For many industrial purposes the use of the pre-heating process will give an excellent finish much more quickly, with less labour and with an appreciable saving in cost.

For those who want to know more about it, the Demonstration Centre offers full facilities for practical demonstrations on customers' own products. What is more, we will gladly train paint-shop operatives at specially arranged short intensive courses—at no cost or obligation to the customer.

This is *your* opportunity to gain impartial and unbiased advice on the process that is revolutionising many industrial finishing procedures. If the process is suitable for *your* product, we will show you how best to use it. If it is *not* suitable we will save you expensive "trial and error".

The photograph shows a corner of the Demonstration Centre with operators hot-spraying synthetic enamels at the water-washed spray-booth. Three types of paint heaters are shown in the illustration. Take advantage of this "know-how" and let us help you to *control* your finish.

Just write to—

Demonstration Centre

JOHN HALL

JOHN HALL AND SONS (BRISTOL AND LONDON) LTD · HENGROVE · BRISTOL 4

industry there are very few motor-car bodies now being produced which are not pre-treated by phosphating. Sheet metal assemblies with light coatings of lacquer or paint have in the past given considerable trouble due to the spoilage of their appearance by filiform corrosion. This takes the form of a lifting of the film in track-like formation, almost as though a worm has burrowed its way beneath the paint film. The breakdown of lacquers of that type is completely eliminated by phosphate pre-treatment.

More recently, phosphate treatment has been applied in the cold working of ferrous metals; in the tube and wire drawing industries the production of a phosphate coating ensures adequate lubrication as the material passes through the dies, thus enabling greater reductions to be made in the drawing operation. Similarly, in the cold forming of difficult shapes in sheet steel, phosphate treatment makes possible a better product and permits a deeper draw to be achieved. Not only is any lubricant which is applied uniformly spread over the surface of the metal being processed, but it is also impossible to disrupt that film of lubricant by virtue of the crystalline phosphate film which is present. The process is also applied to a heavily loaded engineering component which it is difficult adequately to lubricate. The phosphate film ensures that the film of lubricant which is present is not broken down by the stresses which are achieved in service. Parts such as tappets, piston rings and camshafts in the motor industry can be treated in this way, and it undoubtedly gives a better service life.

There are two types of process for general use in producing the coatings generally employed: the unaccelerated processing bath, which is little used these days, and the accelerated processing bath.

Accelerators have previously been mentioned as being mild oxidising agents which improve the efficiency of the processing bath. The most commonly used oxidising agents are inorganic nitrates. nitrites and chlorates, although other compounds have been, and are, used. The function of the accelerators is not completely understood, but it is believed that they increase the ratio of the cathodic to the anodic areas on the metal surface, with deposition of the insoluble phosphates on the cathodes and solution of iron at the anodes. In other words, the efficiency of the process is speeded up.

Choice of Coating

The composition of the coating depends upon the formulation of the treatment bath, and may be straight iron phosphate, zinc phosphate, or iron/zinc phosphate or manganese/iron phosphate. The choice of coating employed will depend upon the nature of the component to be treated, the type of the work and the conditions of application in final use: if required to assist the lubrication of friction surfaces, the type of coating will naturally be quite different to the type of coating required in the pre-treatment of sheet metal components for subsequent painting, and coatings which are to be sealed with an oil film are generally of a heavier nature than those employed for light gauge steel pressings which are to be subsequently finished with lacquer and must possess a high degree of surface finish. Associated manufacturing operations, space available for the plant and the time permissible for processing will also have to be considered in the choice of the process to be employed and the method of applying it.

Solution of the metal in phosphoric acid results in the formation of a series of salts of the metal. The primary salts are soluble in water, but very rapidly hydrolyse with the precipitation of virtually insoluble secondary salts and the insoluble tertiary salts. If the ratio of free acid to the combined phosphoric acid is suitable, precipitation of the secondary and tertiary phosphates takes place at the metal solution interface, a crystalline layer forming on the metal surface, this being the phosphate coating that we are discussing. The corrosion resistance of the coating depends upon its tertiary phosphate content.

The use of an extremely dilute rinse of chromic acid or mixed chromic and phosphoric acids has a pronounced beneficial effect upon the corrosion resistance of the phosphate coating. It has been suggested that immediate drying-off from the phosphating bath without subsequent

WITH

LIQUID ENVELOPE

PEELABLE PROTECTIVE SPRAY-BOOTH COATING

Here is the modern, time saving method of keeping spray-booths clean and free from combustible overspray. Spray walls, ceilings, grills and fans with ' Liquid Envelope ' Spray-Booth Coating. When accumulated with overspray, just peel off like a banana skin.

- ★ **The simplest form of spray-booth coating—sprays on with normal equipment.**
- ★ **Outmodes hand-scraping or grease papering of spray-booths.**
- ★ **Coating peels off in large pieces—easily, quickly and cleanly.**
- ★ **White reflective surface gives better illumination.**
- ★ **Cuts fire-danger.**

A Jenson & Nicholson Product

ORDER 5-GALLON TEST SAMPLE AT BULK RATE

Paint shops all over the country are using this fool-proof method to increase paint-shop efficiency. To enable you to test its outstanding advantages you are invited to write for details of the special offer of **One 5-gallon trial drum** *together with a supply of Cleaner* **at bulk-user prices.**

Industrial Finishes Division, JENSON & NICHOLSON LTD. { **Jenson House, Carpenter's Rd., London, E.15**

rinsing produces a satisfactory finish. There is little evidence to support this view. In fact, there is a mass of evidence to support the opposite view that it is a disadvantage, and it cannot be too strongly stressed that the processing solution must be thoroughly removed, particularly if it is of the accelerated type, before proceeding to the finishing stages, such as sealing with the paint, lacquer or oil.

Process Methods

The methods of processing have been very fully discussed by Mr. Putnam, but, in passing, I should just like to refer to the differential which can occur. The simplest and most widely used method of processing is to immerse the work to be treated in the processing solutions contained in tanks of relatively small capacity. This is generally applied to work on the batch basis, and it involves manhandling of the work from one tank to another, but for components having a large surface area, automatic handling is essential with processing being achieved by the spray method. It must be born in mind, however, that this method is limited to the production of the lighter coatings with accelerated solutions intended as a pre-treatment for painting. In recent years, the immersion and spray methods have been combined for specialised applications such as automobile body treatment. That is to ensure that not only the exposed surfaces but also the invisible surfaces are thoroughly converted. The interiors of the box sections are also phosphated and subsequently coated with a sealing coat of primer paint.

For the processing of large surface areas, such as railway coaches, phosphating can be achieved by a flow application of the phosphate solution, or by the spray gun application of a thickened processing solution. That method in itself may not be as efficient as the full spray method or a complete dip method, but nevertheless it is a great improvement over no phosphating at all.

Types of Cleaner

For the satisfactory conversion of the metal surface, it is essential for it to be rendered chemically clean before the application of the phosphating solution.

Cleaners in general use are of three main types:

(i) Solvent cleaners such as trichlorethylene or white spirit.
(ii) Alkali cleaners, generally mixtures of sodium silicate and caustic soda.
(iii) Emulsion cleaners, consisting of emulsified white spirit in water, to which, to achieve the maximum efficiency, is generally added a small proportion of alkali.

Solvent cleaning using trichlorethylene is the method most widely used in small treatment plants. It is also used for material which has to be treated on site. In this case it is applied by brush or swab. Alkali cleaning is normally employed in large plants. Either the immersion method or the spray method is used. Emulsion cleaning or emulsion cleaner with a small addition of alkali are used in some of the specialised types of equipment, but these methods necessitate application by high pressure sprays.

The usual alkali cleaners are particularly effective: they are used hot and will successfully remove relatively heavy films of contaminants. Emulsion cleaners, to be effective, have to be applied at a high temperature and at a high pressure in the form of spray, as they function partly by the solvent action of the emulsified white spirit and partly by the mechanical action of the spray. Solvent cleaning with trichlorethylene is both convenient and effective for small components, but is considered uneconomic for work of large size. For the latter, in the case of continuous plants, a solvent wipe is often necessary to remove gross contamination with heavy oil or grease before passing through the normal pre-cleaning stage, as such contaminants would rapidly foul the cleaning solution.

The method of cleaning has a very pronounced influence on the weight and the crystalline form of the coating. It would probably be safe to say that absolute chemical cleanliness for a given processing solution results in a heavier and coarser coating than would be achieved if the surface was very slightly contaminated with traces of solvent such as white spirit.

Generally speaking, the alkali cleaners result in much heavier and

much coarser coatings than either the emulsion cleaners or the solvent cleaners, but the weight of the coating produced is of a different order with different processing solutions. As a general rule, pre-cleaning in an alkaline cleaner normally causes the formation of a coarsely crystalline coating, whereas solvent treatment produces a more compact coating of finer crystal size.

Attention must also be paid to the surface condition of the material prior to its entry into the cleaning bath; otherwise the cleaner may have its efficiency rapidly and drastically impaired as the result of gross contamination such as would occur if work coated with a heavy lanoline deposit for the purpose of temporary rust protection is allowed direct into the normal alkali solution. With emulsion cleaners, attention to the initial condition is even more important, as these cleaners will not effectively deal with heavy contamination, and in such cases it is usual to use a solvent wipe to remove heavy deposits of corrosion-resisting protectives or drying compounds used in the form of fatty oils.

Type of Control

The type of control required for the successful operation of the phosphating process will be similar in all types of plant, although the frequency of testing will depend upon the ratio of the surface area of the work being treated, the type of processing solution, the nature of the work, and the type of plant. If the process is only operated intermittently, control testing will need to be less frequent than for a process operated on a continuous basis.

It is essential that the cleaning solution is not carried over into the phosphating bath, otherwise its effectiveness will be rapidly impaired.

Control of the phosphating bath is achieved by titrating a given quantity of the solution with caustic soda. The quantity of the sample and the strength of the caustic soda are generally stipulated by the supplier of the materials. The volume of caustic soda in mls. used in the titration, with phenolphthalein as the indicator, is referred to as the pointage of the solution, and as a general rule the makers supply the necessary information as to the make-up required to maintain the pointage at the desired level. This titration provides a measure of the free phosphoric acid together with the combined phosphoric acid present as metallic phosphates. If free acidity is required—and it may be if anything goes wrong, which is unlikely—it is obtained by a similar titration, using methyl orange as the indicator, or, alternatively, bromo-phenol-blue may be used as the indicator.

From the phosphating bath the work progresses through a rinse or rinses as it is advisable for the processing salts to be eliminated prior to impregnation or sealing of the coating for work of maximum quality. For this purpose, a cold rinse is usually employed, followed by a rinse of dilute chromic acid or mixed chromic and phosphoric acids. It is obviously essential that these rinses, to be effective, must not become unduly contaminated by the phosphating solution, and a check has, therefore, to be made upon the concentration of the contaminant from time to time.

Contaminants effect the crystals on plate coating. This introduces the effect of water. Surprisingly enough, if plain water is spotted on the surface of a piece of phosphated sheet steel blistering will result under conditions of high humidity. That is because most water contains soluble salts. Chromic acid is a corrosion inhibitor, and, although in itself it may not prevent blistering—it does in certain cases—it will certainly retard any under-film corrosion which may occur. By adding 0·2 per cent. of chromic acid which is well above the normal concentration used, to the water spotted on the surface of the plate, blistering is virtually eliminated.

An increasing concentration of contamination from the solution results in an increasing severity of blistering of the paint film.

Both the temperature and the time of processing will obviously have a considerable effect on the efficiency of cleaning when alkali or emulsion cleaners are used, and on processing in the phosphating bath. It is essential, therefore, that the recommendations of the makers and the plant suppliers are maintained within the prescribed limits, otherwise varia-

tion in the quality of the work will occur.

It is possible that work to be processed is already corroded to a greater or lesser degree when received for treatment. That is bad housekeeping and should be avoided, but when work has to be conveyed from one factory to another, perhaps 100 miles distant, such things will occur. Obviously, this condition is most undesirable and must be rectified before phosphating begins. In the case of severe rusting, the only remedy is to pickle with a relatively strong acid solution, but where the corrosion only takes the form of slight discoloration, immersion in a proprietary de-rusting solution, usually dilute phosphoric acid containing wetting agents, or swabbing with such a solution, will be quite effective.

The phosphate coatings in themselves have little resistance to corrosion. To be effective they must be impregnated or sealed in some way. The commonest method of impregnation is simply to oil the work with either a mineral oil or one of the oil-type corrosion inhibitors. For some purposes a drying oil may be used. For parts required to have a pleasing appearance without a full paint finish, it is usual to stain the phosphate deposit with a black spirit stain prior to oiling. This procedure is normally limited to the iron or iron/manganese phosphate type of coating.

Pre-treatment for Painting

As a pre-treatment for painting, the phosphate coating should be relatively light and fine grained in order to provide the necessary key between the metal surface and the paint coating and to prevent corrosion spread should the paint coating get damaged. In the production of such coatings it is essential that the processing salts are adequately removed, otherwise, in the presence of moisture, osmosis can produce undesirable blistering effects with the possible development of underfilm corrosion.

Testing

I now come to the testing of phosphate coatings, and here I want to deal briefly with the day-to-day testing and also with performance testing. The routine testing comprises daily inspection tests to assess the uniformity of coating and the consistency of processing, and may, in addition, include such tests as the the assessment of the weight of coating per unit area of a test piece representative of the work being processed. Performance tests are generally only employed spasmodically and more usually in the assessment of new processes.

With regard to routine tests, as a general rule, the quality of the phosphate coating of a given process —I say "a given process" because it does not apply from one process to another; if you are operating two different processes, the appearance of the coating is likely to vary between the two—is assessed on the appearance and the nature of the surface of the treated work. The appearance will naturally vary with the type of bath which is being operated and with the nature of the work being processed. Thus, processes for the production of a heavy deposit give a coating quite distinct from that produced by processes intended to give a light finely crystalline coating intended as a basis for subsequent painting. For successful processing, the appearance of the coating should obviously be uniform and free from surface dust. Non-uniformity, as a rule, denotes inefficient cleaning or incorrect maintenance of the processing bath. Adhesion of the phosphate coating is determined on a workshop scale by scraping it with a knife or a coin, or by rubbing with fine steel wool. More precise methods of routine process control have been suggested recently by a B.S.I. panel which is fully reported in the Journal of the Iron and Steel Industry for January, 1952. The tests put forward are: weight of coating per unit area; phosphate content of coating; moisture content of the coating; hygroscopicity of the coating; absorption value of the coating.

I am somewhat diffident about mentioning quality control as applied to phosphate treatment, so many people take this term to imply statistical methods of control, and of these I have but a nodding acquaintance. However, a check on the effectiveness of the routine methods of control applied to the process can

be made by putting test panels through the complete phosphating operation and subsequent finishing process at regular intervals, and then subjecting these to accelerated breakdown tests. Such methods are particularly applicable when a new plant is being put into operation, or when a change is made in the method of operation of an existing plant or in the processing materials used, but, having established the optimum working conditions, such tests can be regarded as an insurance against errors due to the human element.

The most satisfactory performance test for the evaluation of alternative coating methods is normal atmospheric weathering, either in fully exposed positions or under cover, depending upon the method of sealing the coating. For painted work and coatings sealed with heavy oils, full exposure may require quite long periods before any breakdown becomes visible—in fact, long periods should be entailed, for otherwise the method is no use—and, for the purposes of check testing, accelerated tests have to be employed. Of these, the most widely used in the past has been the salt spray cabinet, but humidity cabinets may also be employed.

An example of such a test is the C.C.I. Cabinet. The specimens are exposed on racks to highly humid atmospheres obtained by heating the water bath at the base of the cabinet and cycling the temperatures within the cabinet from 42° to 48° C. with a rise or fall each half-hour. In other words, it involves the exposure of the panels at that relatively high temperature in an atmosphere saturated with water. Although this test is essentially a paint breakdown test, it will obviously function as a performance test for work which has been phosphate treated before painting.

B.S. Publication 1391/1952 covers performance tests for protective schemes and relates specifically to the A.R.E. salt drop test and the C.R.L. sulphur dioxide test. In the A.R.E. test the specimens are sprayed daily with synthetic sea water to form a mist on the surface and then suspended over a water bath under a canopy to maintain a highly humid condition. The C.R.L. sulphur dioxide test prescribes exposure of the specimen in a beaker containing a dilute sulphur dioxide solution (0·3 gm./100 ml.) surrounded by a cooling coil. In this, the sulphur dioxide solution is heated and a corrosive atmosphere is produced within the beaker, that being condensed on the surface of the specimens so that corrosion is accelerated.

DISCUSSION

Mr. R. J. TREVELYAN: (Santon Ltd.): I have been concerned recently with installing a small plant for phosphating, and it was laid down on the assumption that all the treatment could be done continuously by chemical means. In actual practice, the assemblies that are being treated are welded steel assemblies which have been welded with oil on the surface, which produces a carbon deposit. We have found that in the process, particularly the derusting side of it, after degreasing by trichlorethylene, we have a carbon sludge formed on the surface of the metal. This sludge is very easily removed by wiping, but it means that the work has to be removed from the line for that to be done. Can Mr. Brown describe any chemical means whereby the carbon sludge can be removed?

Mr. BROWN: It seems to me that the main trouble lies in the fact that prior to pickling you are not adequately degreasing. In order to ensure satisfactory cleaning or conditioning of the surface it will be essential to remove the oil film by solvent treatment or by an alkali cleaner. I imagine that the work with a contaminated surface is going directly into the pickle.

Mr. TREVELYAN: That is not quite right. The work itself is oil-free except at the points where the welding has taken place. There is a hard tenacious carbon film which can be removed by wire brushing. That film becomes softened and in the form of a sludge after going through the trichlorethylene and after going through the derusting solution. It is at that stage that it is softened and can be removed by wiping. We have not yet come across a solution which will take the sludge away and so prevent our having to take the work off the line.

Mr. BROWN: I imagine that you are using a mild derusting solution and not a strong one. You are degreasing with trichlorethylene and then going into a strong acid pickle. I see no reason why an acid deposit should not be removed.

Mr. TREVELYAN: We are going into a mild phosphoric solution.

Mr. BROWN: Far be it from me to decry a mild one. It seems that you need something stronger to remove that. The phosphoric solutions are eminently suitable for derusting where the rust is of a mild nature and where the contaminant, such as you are referring to, is light, but in the case of welding, if you have an oily surface you can produce quite difficult deposits. You need something stronger to remove your deposit, probably a stronger phosphoric solution.

Dr. S. G. CLARKE (Ministry of Supply): With regard to the last speaker's remarks, a possible solution for his trouble is to degrease before welding and then he will not burn carbon on the surface and have to remove it.

Dr. E. MARKS (Richard Thomas and Baldwins Ltd.): We are interested in phosphating in the sense that we want to produce a surface on the steel which will have some electrical resistance rather than corrosion resistance. I was interested in the remarks about the relative rate of spray phosphating and immersion phosphating. I gathered that there was a difference in the amount or weight of coating produced; in other words, although spray pickling was faster, the coating produced was very much thinner. I should like to know whether that is true or whether there is a difference in the rate, and, if there is a difference in the rate, why should there be?

Mr. BROWN: Obviously, all phosphate coatings provide electrical resistance.

With regard to the rate of build-up or the weight of the coating, there is no reason why the spray application and the dip application should not produce a similar rate. It is largely a question of time or temperature. Very largely, this goes back to the question of why spraying cannot be applied to certain processes; it is due to the fact that at high temperatures spray applications are inconvenient in the shop. The heavy deposits are normally produced by the dip process at the higher temperatures. If you want to spray, you can, but it may not be convenient. Does that dispose of your question?

Dr. MARKS: Not quite. The question was: Assuming the same weight of coating, is spray pickling faster with any solution than the dip process?

Mr. BROWN: That is rather a difficult one. I would say that you can produce the same effect in a given time but you may have to modify the strength of the solution. For a given strength of solution, the spray application should, theoretically, be faster than the dip operation because you have the mechanical effects of the spray on the surface. That is the suggestion that I put forward. Nevertheless, you can produce equal deposits by spray or by dipping in a given time by ringing the changes on the strength of the solution.

Dr. S. WERNICK (The Institute of Metal Finishing): One of the difficulties which the student of phosphating encounters is the conflicting statements one comes across in the Technical and Commercial Press on which one would like to seek enlightenment. I want to ask one or two quite elementary questions of Mr. Brown.

First, there is the question of crystal sizes. It is not clear from what Mr. Brown said whether he advocates large, medium or small grain sizes.

Furthermore, what methods are used to control and to maintain a given crystal size or grain size?

My other point is with reference to thickness of coating. One gets the advocate of the thicker coat and the advocate of the thinner coat. The man who advocates the thick coat usually feels that he is getting better protection. The man who advocates the thinner coat feels that he does not get the adhesion. Where does the truth lie? Is there a specified thickness of coating at which we should aim?

With regard to chromic acid as an after-dip for stoving, I was interested in Mr. Brown's pictures because they rather bear out some recent work which has been carried out in the States and has recently been published. It would appear that a higher concentration of chromic acid seems to give rather better results. That seems to be rather counter to the tendency in this country to drop the concentration of chromic acid almost to vanishing point.

I was a little sorry that Mr. Brown did not emphasise a little more heavily the point that it is essential that work entering a phosphating plant must be free from rust.

Mr. BROWN: Dr. Wernick spoke about conflicting statements. I suppose that as long as there is science there will be conflicting statements, whatever the subject.

As to which crystal size is best, I do not think there is much argument there that for a given process the smaller the crystal size, particularly if it is pretreatment for paint, the better will be the adhesion of the coating. The smaller the crystal size is the lighter will be the coating, whereas a large crystal size is generally associated with a heavy coating—not necessarily so, but it is a general rule.

Controlling the deposit by taking surface replicas would be a useful method of examination, but in practice if a phos-

phating plant is properly operated, any change in crystal size is usually visible to the unaided eye, even though you cannot see the crystal formation; that is, although you cannot see the individual crystals, the general appearance is appreciably altered if there is a change in any conditions which influence the crystal size. It is quite obvious.

Chromic acid concentration is to some extent a matter of convenience. If you get too heavy a concentration of chromic acid there is a danger, if drying-off is not uniform over the entire surface of the article, that you will get a build-up of the chromic acid crystals on the fringes of the drain marks, and those in themselves are undesirable. So it is generally advisable to adopt the minimum chromic acid concentration which will give you a satisfactory performance by the finished article whether it is sealed with oil or a hard coat, such as paint.

I have already referred to the fact that the thickness of the deposit is related to crystal size to some extent. The requirement is, again, dependent on the application of the coating. For a paint sealing application a light coating is essential in order to achieve maximum adhesion of the paint film. If you have a heavy coating, adhesion will be greatly reduced but your corrosion resistance wi!l not be impaired; in fact, the corrosion resistance of any part that is inadvertently exposed may be slightly better. However, it is a moot point. But the general performance will be reduced, generally speaking, in relation to the thickness of the coating, although it would be safe to say that a minimum thickness is required, but I do not know what it is.

With regard to the need to achieve freedom from rust when the work comes into the plant. Generally speaking, the people in charge of properly run plants make sure the work is almost virgin when it enters the plant and they know that any discoloration they see later is due to some fault of operation, such as bad sludging and picking up sludge as the work goes through the plant.

Mr. R. E. SHAW (Development Section, Paints Division, Imperial Chemical Industries Ltd.): I should like to ask Mr. Brown's views on one aspect of phosphating. I know that the larger American motor firms regard phosphating as a form of insurance and also as an aid to their inspectors because it is very much easier to see grease or rust on a body which has been phosphated whereas if no phosphating process were used it would largely go undetected, with dire results to the durability of the paint films. What are Mr. Brown's views on that?

Mr. BROWN: I would entirely agree that phosphate treatment is a form of insurance and does ensure adequate cleanliness of the work prior to painting. In the absence of phosphate conversion, it is virtually impossible to say that the surface of a large mass of material is chemically clean. I also agree about grease or rust. Obviously, the rust should be removed before the article received the phosphating treatment; otherwise it may be masked as a result of the phosphating treatment. I would also agree that it is an aid to inspection, and it does ensure cleanliness when the job enters the finishing operation.

Mr. L. BARLOW (Raleigh Industries Ltd.): I would ask Mr. Brown to revert again to the chromic acid rinse. I had some experience of a rinse giving an apparent etching effect. This appeared to be due to running the rinse at a low temperature, between 145° and 150°, but when the temperature was put to 160° and above it appeared to be all right. Can you give me any information as to whether this is so?

Mr. BROWN: I cannot give you any help about the etching effect at a temperature of 145-150°. In one plant for which I have a nodding responsibility, we operate the chromic rinse cold and achieve perfectly satisfactory results. Why there should be an apparent etching below 160° and not above 160° I cannot tell. In any case, I should have thought that it would have been difficult to see the etching effect if you had a satisfactorily converted steel surface.

Mr. H. DARBY (Edward Curran Engineering Ltd.): One often hears the comment that the finish on the modern car is not so good as that on the pre-war car. I dare say that Mr. Brown will refute that. If there is an element of truth in that, what are the weaknesses in phosphating and what is being done to overcome them? I have a car which is about fifteen months old, and already parts of the enamel have chipped off and rust is showing underneath.

Mr. BROWN: With regard to the debatable point whether the finish of post-war cars is equal to that of the pre-war cars, if you were given a pre-war car now you would have exactly the same complaints to make as you have with your modern car; in fact, your complaints would be a lot worse.

If the process is properly operated, there are no weaknesses about phosphating a motor-car body, and you get a good key for the paint and you prevent the spread of rust underneath the paint film. If you apply a process like the "Rotodip" you will deal with certain surfaces which you cannot see and make sure that they are in a sound condition, and you will not be left, as with many pre-war cars, with a car body consisting

of a film of paint with nothing underneath it.

Mr. D. I. MACFARLANE (Machine Shop Magazine): I am interested in the phosphating treatment of machine tool frames, very heavy ones, such as lathes, millers and drilling machines. We have heard a lot about the dipping and spraying of parts in warm solution. There has been only a small mention of a cold treatment with a paste. Could we have some more information about that?

Mr. BROWN: I do not profess to know very much about this. All I can say is that flow treatment of heavy masses of material can be quite successful. It can be applied either by flowing or by applying a thickened spray solution. It is not a new process; it has been applied on large structures, such as bridge structures. You can be sure that the civil engineers would not adopt such a process if it were not effective. I do not know of any actual experience, but you can rest assured that if the process is properly applied your final assembly will be very much better than if you apply your paint without using such a process.

Mr. W. PARRY (Santon Ltd.): Will Mr. Brown comment on the fact that it was once remarked by Dr. Coxon at a conference of metal finishers that the Continent favoured the longer process? Why is the longer process favoured on the Continent? Is it because the crystal structure is smaller because the chemical change is proportional to the temperature or the square of the temperature?

Can you give any information on the effect on corrosion resistance of the relationship of the phosphates in the solution to the free phosphoric acid?

Mr. BROWN: I am afraid you are getting me a little involved. First, I do not think it is right to say that the Continental people prefer the longer process. In the motor industry, some of the Continental users are using very much shorter processes than are used in this country. In fact, the degree of conversion they are getting on the steel surface is virtually infinitesimal. Processes of that type have been used in the U.S.A. Although they are better than nothing, they do not produce an effect equal to that of the conventional phosphating treatment as used, generally speaking, in this country. You can say that they are almost a stage between a phosphoric acid pickle and the phosphating treatment as applied over here.

I do not feel justified in commenting on the relationship of corrosion resistance to the phosphate content of the solution. Perhaps Mr. Shaw would help with that?

Mr. R. E. SHAW (Development Section, Paints Division, Imperial Chemical Industries Ltd.): With the non-separated processes it is a fact that the acid content needs strict control. If you have too little free acid it forms rather a lot of sludge; if you have too much acid present you get too thin a coating. These processes have to be balanced according to production requirements in the plant so that you get the required depth or weight of coating with minimum sludge formation.

With the accelerated processes, they tend to form a balance whether one takes special precautions or not; but if the chemicals are not reasonably well balanced in the tank you will waste prodigious quantities in sludge formation or in extra free acid or in excessive attack on the articles being processed to get rid of the excess acid.

Mr. PARRY: Is there any optimum ratio between the two?

Mr. SHAW: In the accelerated zinc phosphating process we reckon on an acid ratio of ·175 and in the non-accelerated process about ·13.

Mr. J. DIXON (The Standard Motor Co. Ltd.): An aspect which has not been mentioned is phosphating as an aid to lubrication. We have used it in conjunction with colloidal graphite. We were drilling a steel shaft in a cast-iron bearing and at first we had trouble with it seizing up. Since we started phosphating and applying colloidal graphite suspended in tetrachloride fluid it has improved. We use the solution at approximately half strength.

Mr. BROWN: That is the sort of result you would expect with a heavily loaded bearing. A steel shaft in a cast-iron bearing is not a desirable type of assembly, but it is not uncommon. The trouble relates to the loading and the method of lubricating. If you have ample lubricant and keep the bearing cold, you do not need the phosphating treatment, but the phosphating treatment in itself will go a long way towards solving the problem, and gilding the lily, as it were, with colloidal graphite takes you a stage further towards reducing the coefficient of friction and so achieving satisfactory results.

B.H. Chemicals Ltd.—Mr. J. Williamson, personal assistant to the managing director of B.H. Chemicals Ltd., has been appointed to the board of that company as from the 1st January, 1953.

Price Reductions.—Shell Chemicals Ltd. has announced a reduction in price of a number of their products as and from the 19th January, 1952. The products affected are Shell "Acetone," "Alphanol" 79 and "Nonanol."

QUIETER · SMOOTHER · MORE EFFICIENT · MODERN

A product of Britain's foremost manufacturers of Polishing Shop equipment

Morrisflex

NON-STOP POLISHING LATHE
WITH INDEPENDENT SPINDLES

B. O. MORRIS LTD., BRITON RD., COVENTRY
Telephone Coventry 5081-2-3 Telegrams "Morisflex" Coventry

Practical Spray Applications of Synthetic Resin Enamels

A NUMBER of practical points arise in the spray applications of synthetic resin enamels which from experience, are contended to give the most reliable results, but which, of course, have to be varied from time to time in respect of the particular class of work handled. Extensive possibilities have been opened up since the introduction of glycerol-phthalate mixtures synthetised with china-wood and soya-bean oils for the finishing of metal parts, but despite these developments, still better synthetic thinners are being searched for.

Formerly, varnish was supplanted by nitrocellulose lacquers which only necessitated much shorter periods of application, and ensured longer service. In order to reduce the natural brittle disposition, however, plasticising agents used tended to diminish adhesion, while stability to sunlight was reduced. This in turn revived interest in oil-resin mixtures, whereby suitable proportions of china-wood and soya-bean oils acted as the carrier base. Phthalic acid anhydride, as obtained from coal-tar naphthalene, is used to form glycero-phthalate, and by synthetisation with the oil components, the resinous qualities of the final product are obtained.

Accurately Controlled Procedure

A careful selection of the thinner forestalls troubles which might eventually be experienced in baking latitudes, since although on the one hand a rapid high-solvency thinner permits more enamel to be applied, a slower thinner "levels" better. All enamel mixtures, after thinning, are preferably strained through two layers of selected cloth, where, by keeping the strainer below the surface layer, the best results accrue. In subsequent application of the enamel, spray pressures range from 15 to 20 lb. per sq. in., while the best viscosity for this varies from 17 to 20 sec. at 80° F. when initially tested.

With metal surfaces of large size, these are first prepared by washing with oleum spirits, applying any bumping-out required, and finishing thoroughly, followed by a washing and flushing treatment. One mixture recommended for this washing and flushing is made up of a phosphoric acid alcohol preparation, but others have also been successfully used. After the parts have been scrubbed with this acid solution, they are again flushed with water, and also steam, to get rid of any remaining acidity, and dried. The drying temperature is preferably around 240° F. and depending on the size of the parts, usually occupies some 20 min. For those sections such as weld areas which may require a heavy finish, metal-glazing then follows, and which sections are air-dried for up to some 10 min.

In order to ensure reliable water permeability, what is regarded as an oil-type of primer is more satisfactory than those of the synthetic variety. Great care is necessary in the application of the primer surface, and the material should not sag when set, while in the dry state should finish over 0·002 in. A selected fine-grit paper is then used to sand the treated surfaces after leaving the prime oven, but although water-sanding may be taken advantage of, this means extra treatment of the glazed areas, and the added operations of oven-drying, but whichever process is engaged, pyroxlin putty is used to glaze metal scratches.

The Different Enamel Coats

The parts are now ready for the first enamel coat, which is then applied and baked for a specific period, depending on the temperature used, since the same results can be acquired by a ½-hr. treatment at 325° F. as one hour at 250° F. The use of infra-red lamps in this connection has already been dealt with, and need not be repeated. Final enamelling is carried out on much the same lines, but no attempts are made to reduce

Figure it out for yourself

PHOSPHATING -

22 Separate Processes, in the —

4 Famous Ranges — "**Parkerizing**" "**Bonderizing,**" "**Spra-Bonderizing**" "**Parco-Lubrizing,**" covering —

9 Distinct Spheres of Application in Bonding Paint and Adhesives, Resisting Corrosion, Assisting the Cold Working of Metals, in over —

1500 Plants throughout the British Isles including more than —

60 Fully Automatic and Mechanically Operated Machines, from which we have gained —

25 Years Wide, Varied Unequalled Experience.

GRAND TOTAL "*KNOW-HOW*"

Our unrivalled knowledge of Phosphate processes, consolidated by long experience, and including the latest information on American and other foreign practice is entirely and immediately at your disposal. Let us give you the practical and economic solution to your own Metal Finishing Problems. Our Telephone number is —

3444 EALING

THE PYRENE COMPANY LIMITED, METAL FINISHING DIVISION, GREAT WEST RD., BRENTFORD, MIDDX.

the hours baking at 250° F., at least where the highest class of work is handled.

Before leaving the first enamel stage, however, close inspection is made to detect if any dry areas, pits, scratches or similar defects exist. Since otherwise economical processing would not be attained, the lighting used should emphasise the highlights of the treated parts during this inspection. Except in rare instances, one should not need to resort to costly repetitions of the work such as re-priming, drying and sanding the bare metals at subsequent stages, if the necessary care has been given at the proper places.

The next steps in the finishing treatment are pyroxlin glazing, sanding, washing with water, drying, and re-washing with light naphtha. (If petrol is used, care has to be taken that this is of the non-lead, pure grades only.)

After the final enamelling has been completed, examinations reveal if too much or too little enamel has been applied, and it is desirable that only the exact amount be used. With too little enamel, undercoats and uneven finishes are exhibited, besides dry areas, whereas with too much enamel, tacky proportions requiring lengthy dry-out periods develop, while the enamel itself sags or tends to crinkle.

Although organic lakes are used by the makers for light blues, and synthetic pigments for yellows, etc., some firms still believe in the advantage of iron cyanide for dark blues, and yellow iron oxides for greens.

Titanium and antimony oxides remain unsurpassed for imparting the best whites.

Direct Immersion

Finally, reference should perhaps be made to direct use of synthetic resin enamels, but which permits of only limited application for the best grades of work.

For dip treatment of sheet metal parts, a fine ground agent is first used for priming, followed by baking at 350° F. for an hour, and after removing surface imperfections, dipping is done in the previously thinned mixture. The final baking does not differ from the former 250° F. mentioned. Thinning is done until from 20 to 24 sec. of viscosity is reached by additions of naphthas, either of the high-flash or high-solvency varieties, according to specifications in respect of colour and oven treatment, but some operatives believe in the use of butyl alcohol oleum spirits as the best agent for this purpose.

Between infra-red heating, selected lighting during inspection, and the use of improved instruments for examining metal surfaces, the work has today been raised to the highest order of perfection, but despite this, still further researches are in progress to speed-up output, and render applications more economical.

DRY CLEAN AIR AT CONSTANT PRESSURE

DESIGN changes and improvements in compressed air rectifiers and reducing valves produced by The Hymatic Engineering Co. Ltd., of Redditch, Worcs., have resulted in the development of a single high precision model capable of meeting all the operating conditions previously catered for by four alternative Hymatic units. The maximum inlet pressure is now 200 p.s.i.

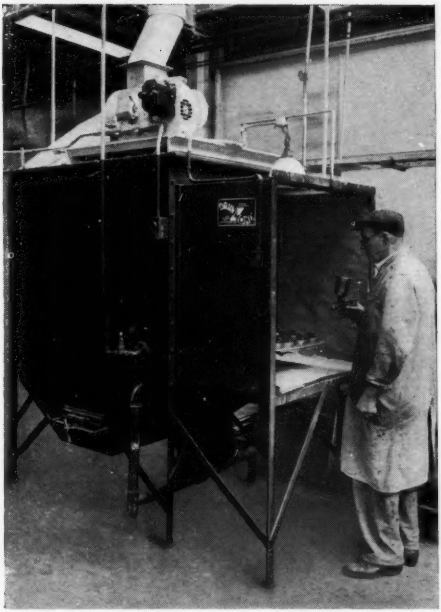
The new rectifier, type R50, removes oil and water from high pressure air supplies and delivers dry clean air at controlled pressures. This prevents corrosion and stoppages arising from the need for too frequent overhauls. For spray painting the rectifier is particularly valuable as no spray gun can give a first-class finish with oil and water in the air supply.

Each rectifier can be used with up to three average industrial spray guns or combinations of guns and tools, consuming up to 25 c.f.m. at accurately determined pressures ranging from 20 to 180 p.s.i.

The high pressure supply, entering the unit at high velocity through a special orifice, is directed downward in a rotating spiral motion which centrifugally separates many of the impurities. It then passes upwards at a slower speed through an efficient "scrubbing" medium and is finally delivered clean and dry at the reducing valve or alternatively at the high pressure outlet.

Oil and moisture separation takes place in an anodised light alloy cylinder fitted with filters and a special

WATER WASH SPRAY BOOTHS *of* GREATER SIMPLICITY *and* HIGHER EFFICIENCY



There are no pumps, nozzles or filters to choke or need attention. The only moving part is the fan, which handles the clean dry air from the high efficiency wash and discharges it to the atmosphere.

We can supply the washing plant in separate units for building into your own booths, to give the above advantages. We can also offer the same advantages of clean exhaust with very little maintenance for DUSTS AND FUMES FROM POLISHING, GRINDING AND PLATING

DRUMMOND PATENTS (HOLDINGS) LTD

5 GREAT WINCHESTER STREET, LONDON WALL
LONDON, E.C.2

Telephone: LONDON WALL 4432 & 2626

separator element. The deposit is drained off periodically through a tap at the base. Servicing, required only at infrequent intervals, is simple since the complete separator unit can be removed for cleaning by unscrewing the base nut.

The reducing valve element, extremely sensitive to pressure variations, is designed to operate smoothly and without pulsation by a system of continuous counter-balance. Acting behind a sealed piston, a spring meets the reaction of the lower pressure air in such a way as to open the valve admitting a compensatory supply of dry clean air from the rectifier precisely in time with a fall of pressure on the outlet side. The outlet pressure can be varied at will by a knob at the top of the unit arranged so that it cannot be unscrewed too far.

Specification:

Overall Dimensions: 14½ in. H., 4⅜ in. Deep, 8 in. W. (36·9 cm. by 11·1 by 20·3). Weight: 7¼ lb. (3·29 Kg.).

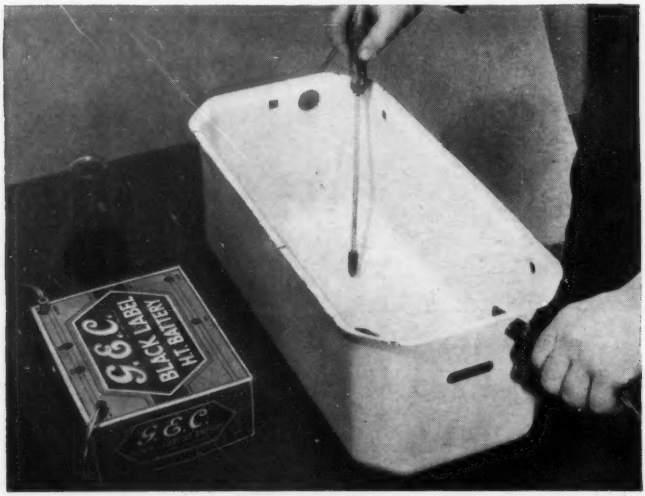
Performance: Maximum inlet pressure 200 p.s.i. Outlet pressure—from 20 p.s.i. to within 20 p.s.i. of inlet pressure. Flow—up to 25 c.f.m. per min.

Connections: ¼ in. B.S.P. male inlet and outlets. Clean air—high pressure connection—⅜ in. B.S.P. (normally plugged).

Mounting: Two holes for ¼ in. bolts on 4 in. centres. Flange thickness ½ in.

Finish: Polychromatic Hymatic blue castings. All parts suitably protected against corrosion.

De-watering and Rust Proofing.—Tool Treatments (Chemicals) Ltd., Colliery Road, Birmingham Road, West Bromwich, announce a process plant and solution dealing with de-watering and rust proofing. A leaflet gives specification details and an illustration of the equipment.



Fordhams Pressings Ltd., 5 Bridge Street, Ludgate Circus, London, E.C.4, now use an ingenious method for detecting possible flaws in the vitreous enamelling of their well-known pressed steel flushing cisterns. A pointed felt finger soaked in a special pink saline solution is passed over any suspicious flaw marks in the enamelled surface, both inside and outside. If a mark, however small, is bare of enamel, it is immediately detected by a spark from electricity passing through the insulated finger holder to the earth of the cistern-casing via the felt finger point

SHOW THIS TO YOUR PLATER

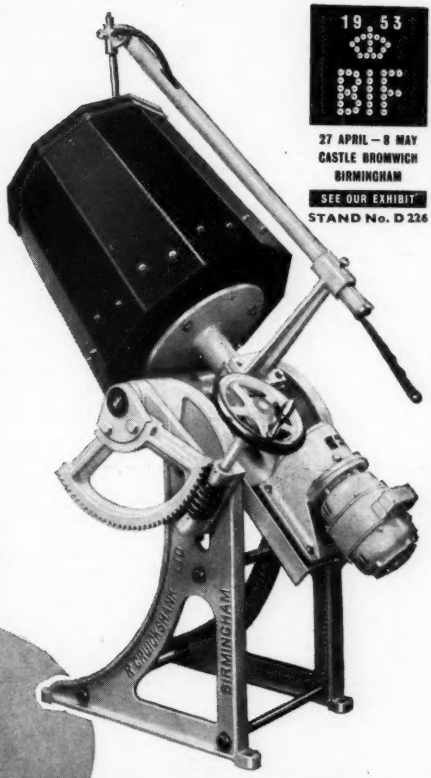
EASY ON THE OPERATOR

NEGLIGIBLE MAINTENANCE

INTRODUCING DIRECT GEARED MOTOR DRIVE

OUTCOME OF MODERN ENGINEERING DESIGN

RELIABLE IN PERFORMANCE AND STRENGTH



1953 BIP

27 APRIL – 8 MAY
CASTLE BROMWICH
BIRMINGHAM

SEE OUR EXHIBIT
STAND No. D 226

CRUICKSHANK'S

SENIOR PLATER

This new model Senior Plater is offered to industrial platers with every confidence. There are no belts to wear, slip or break; no belt guards and no awkward raising and lowering operations.

The machine is of streamlined design with easily operated worm and wheel mechanism, and it is therefore less likely to cause accidents or loss of solution.

R. CRUICKSHANK LTD
CAMDEN STREET, BIRMINGHAM 1

Telephone:
CENtral 8553 (6 lines)
Telegrams:
Cruickshank, Birmingham

SM/C. 500c

The Effect of Climate and Atmospheric Pollution on Corrosion

THE following is a synopsis of a paper by J. C. Hudson, D.Sc., F.I.M., and J. F. Stanners, B.Sc., which was presented under the above title:

The results of routine observations on the corrosion of the small reference specimens of ingot, iron or zinc exposed at the atmospheric testing stations of the Corrosion Committee all over the world are presented and discussed. The data, which relate to more than twenty sites and up to twenty separate annual tests at each, provide a good indication of the effect of climatic differences on atmospheric corrosion.

In Great Britain, where for most of the year the climate is sufficiently humid to promote corrosion, the determining factor for its severity is the sulphur pollution of the air. Tests made in collaboration with the Fuel Research Station at sixteen sites where the atmospheric pollution is measured have shown an almost perfect correlation between the amount of sulphur dioxide taken up from the atmosphere by lead peroxide pollution gauges and the rate of corrosion both for steel and zinc.

In the absence of sulphur pollution, corrosion at the sites overseas is generally slight; in dry climates it is negligible. For example, tests at Delhi indicate that the resistance of the Delhi pillar to corrosion is to be attributed to the mildness of the corrosive conditions there rather than to any superiority of the iron itself.

Corrosion on surf beaches in the tropics, may, however, be exceptionally severe. At Lighthouse Beach, Lagos, Nigeria and at Kure Beach, N.C., U.S.A., the corrosion rates for steel are about five times greater than those in the most corrosive industrial atmospheres in Great Britain. The severe corrosion at these places is associated with the salt spray from the sea and the rate of corrosion falls off rapidly with increasing distance from the surf line.

Preliminary tests on specimens exposed at different heights on the Sutton Coldfield television mast suggest that the effect of distance from the ground is secondary to the natural variations in corrosion rate from one year to another.

Some details of experimental technique are discussed. Work, in which American investigators have collaborated, has confirmed that at low copper contents variations of a few hundredths of 1 per cent. in copper content have a marked effect on the corrosion resistance of ingot iron. Because of the increasing difficulty in controlling the copper content of different batches of ingot iron, the small reference specimens used in the Corrosion Committee's most recent tests have been made of copper-steel instead of ingot iron. The copper-steel now in use contains about 0·3 per cent. copper; minor deviations from this figure should not effect the corrosion rate within the experimental error. It has also been found that, although it is advisable to stir the inhibited hydrochloric acid solution (Clarke's solution) used for de-rusting exposed iron or steel specimens after test, failure to do so does not impair the accuracy of the results, at least for ingot iron or copper-steel.

PACKAGING EXHIBITION

THE Packaging Exhibition was held recently at Olympia, London, and among the exhibitors were **F. A. Brough and Co. Ltd.**, 4 Upper Parliament Street, Liverpool 8, who displayed a range of steel drums and kegs, metal drums and metal cans and canisters, and various containers, together with suitable closures for carrying paint, oil and grease, insecticides and chemicals, etc.

Minnesota Mining and Manufacturing Co. Ltd., Arden Road, Adderley Park, Birmingham 8, exhibited a full range of their well-known "Scotch Boy" tapes, and equipment for handling packaging tapes, including manual box sealers, single and multiple label dispensers, and laminators.

Teleflex Products Ltd., Teleflex Works, High Road, Chadwell Heath, Essex, exhibited working displays of their dual-directional chain conveyor, ·705-in. overhead cable conveyor and their newly-developed industrial remote-control gearing. Static sections of their ·5-in. cable conveyor and the Teleflex torsion conveyor were also displayed.

Jenson and Nicholson Ltd., Jenson House, Carpenters Road, Stratford, London, E.15, featured "Liquid Envelope," a packaging material which can be sprayed on to metal, wood, fabric, paper or plastics as a protection against deterioration during storage and transit, together with a new dip-coat protective coating which is claimed to be acid proof and impervious to water.

Other items were "Paprinol" paper varnishes, "Jenorotin" tinplate finishes, and "Cuprinol" wood and fabric preservatives.

PRODUCTION PROVED PRODUCTS

SUNBEAM ANTI-CORROSIVES

SPECIALISTS IN INTERMEDIATE METAL FINISHING

Manufacturers of

STRIPALENE Regd. — For the removal of paints, carbon, and other contaminating deposits

FERROCLENE Regd. — A most effective rust and scale remover for ferrous metals, including stainless steel, supplied in different grades

ALOCLENE Regd. — Acid cleaner for removing oxide films from aluminium components prior to spot welding.

FERROMEDE Regd. — For the de-watering and protection of metal parts during processing or storage

There are various grades of each of the above products availabie to meet all technical requirements and comply with Government specifications.

SUNBEAM ANTI-CORROSIVES
LIMITED

CENTRAL WORKS : CENTRAL AVENUE
WEST MOLESEY : SURREY

Telephone: Molesey 4484 (5 lines)
'Grams: Sunanticor, East Molesey

Sprayed Aluminium Coatings

AN interesting example of prolonged protection afforded to a steel building in Sheffield by a sprayed aluminium coating was recently reported to the Protective Coatings (Corrosion) Sub-Committee of the British Iron and Steel Research Association. It was brought to the attention of B.I.S.R.A. by Mr. H. Bull, managing director of Brown Bayley Steels Ltd., and concerns his company's Test House.

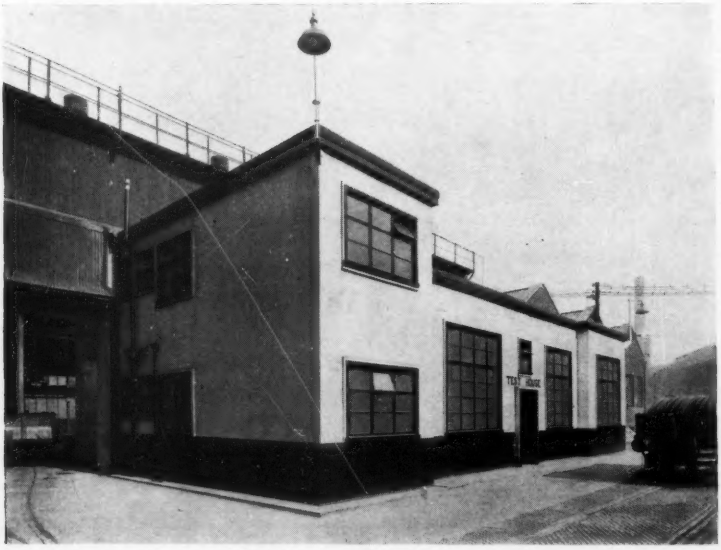
This Test House was built in 1937. It is about 60 ft. long by 25 ft. wide. The height is about 15 ft. in the middle and 20 ft. at one end, where there are two stories. One of the long sides abuts upon a workshop, so that the total area of the Test House walls, which are of $\frac{1}{2}$ in. steel plate, is roughly 2,000 sq. ft.

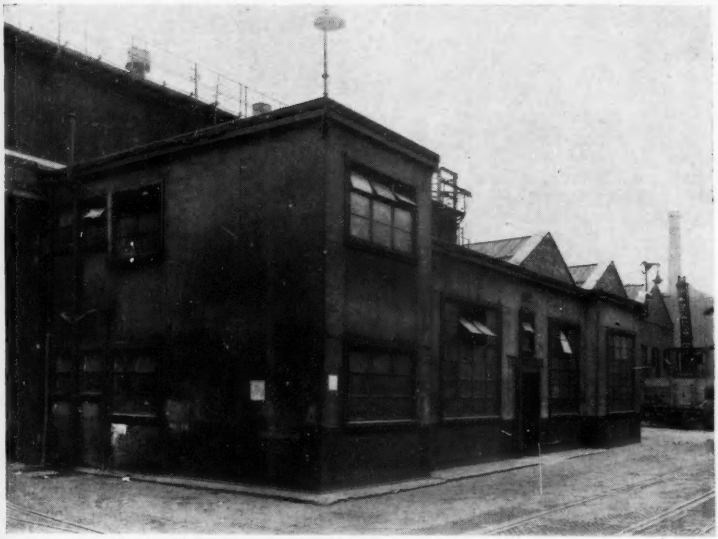
The outer surfaces of the steel plates were grit blasted and sprayed with aluminium when the building was erected, after which a dado of about 3 ft. all round the building was overcoated with two coats of black bituminous paint and a single coat of lacquer. The cost per sq. ft. of the complete protective scheme was 3s. 3d.

The work was completed in March, 1938, and the building was left as it was until the outbreak of war in 1939. Thereafter, during the war years, the Test House was used as a strong point, for which purpose its walls were encased with a sand revetment to a height of about 10 ft. The sand may have damaged the aluminium coating slightly in places but when the revetment was removed in 1946 the coating was virtually intact and it was considered sufficient to repaint the building. Two coats of bituminous paint were applied to the dado and above this two coats of an aluminium paint.

In June, 1952, the Sub-Committee found that the sprayed aluminium coating was still in very good condition. Some slight rust-staining could be seen in places; at others there were small patches of rust, about 1 sq. in. in size, where the coating has been in contact with the sand. Appreciable rusting was only observed at one place, where in a narrow band about 3 ft. wide over a window some 10 per cent. of rusting had occurred. Otherwise the coating was in excellent condition. It will, however, be advisable to repaint it soon, for signs

Below: The test house of Brown Bayley Steels Ltd., after completion of spraying in 1938, one year after it was built. The 3 ft. dado at the bottom is black bituminous paint





The Brown Bayley Steels Ltd., test house photographed in August 1952—The ravages of 14 years have been well resisted by the sprayed aluminium coating

of pending breakdown were apparent and fifteen years is about the maximum life that can reasonably be expected from a sprayed aluminium coating in such a highly corrosive works atmosphere.

It will be recalled that recently 15,000 to 20,000 tons of steelwork at the Abbey Works, Margam, the largest steelworks in Europe, has been shot blasted and given a 0·004 in. sprayed coating of aluminium before painting. It has been stated that the cost of this scheme was "not more than two-and-a-quarter times that of the more usual specification of weathering and wire brushing before the application of red lead primer and finishing paints, as applied to the remainder of the steelwork at the Abbey Works, the life of which is expected to be five years." The life of the aluminium sprayed coating may be "up to twenty years," while the single coat of paint on top of it will be renewed every seven years after simply washing down the old paint.

The total costs of anti-corrosive treatment at Margam over a period of fifty years for the metal sprayed work are thus likely to be just under half those for the ordinary painting treatment.

British Standards House.—The British Standards Institution has announced that it will move at the end of next summer into a single, self-contained office block, to be called British Standards House, at 2 Park Street, Mayfair.

DEATHS OF MR. ARTHUR AND MR. HAROLD FARMILOE

The deaths have occurred, within a few days of each other, of Mr. G. Arthur Farmiloe and Mr. Harold Farmiloe, cousins and joint managing directors of T. & W. Farmiloe Ltd.

Mr. G. A. Farmiloe, who was 87 when he died on 10th January, was also chairman of the company, with which he had been for seventy years. Always an energetic business man, he continued to the end to arrive at the office each morning at 8.30, never leaving before 6.15 at night.

Mr. Harold Farmiloe had been in failing health for the past year, and died on 2nd January, aged 80. He had been with the firm for sixty years, having gone straight from Cambridge into the business in 1893. With Dussek Bros. he took a leading part in the formation of the National Association of Putty Manufacturers before the last war.

The Board will now consist of Mr. Harold Farmiloe's two sons, Mr. Eustace Farmiloe (who has been with the company twenty-six years) and Mr. Leslie Farmiloe (with the company for eighteen years), Mr. J. D. Farmiloe (who was a practising barrister before the last war and joined the company on leaving the R.A.F.), and Mr. A. W. H. Thomoson (secretary and director of the company).

LEAD CYANAMIDE DK 825

Abstract of a lecture by Dr. H. Zirngibl of the Duisburger Kupferhutte

IT is common knowledge today that the rust-preventive action of systems based on organic binders is mainly due to the combined function of binders and pigment. It is known that the pigment can cause alkaline passivation (by rendering the swelling water alkaline) as well as anodic passivation (in general terms, oxidation of the surface of the iron). A further pigment action is attributed to the improvements of binders by an increase in resistance to swelling of the binder as a result of chemical reaction such as so-called soap formation. Over and above that, the particle shape of the pigment plays a certain part. With the development of high-grade synthetic binders, the importance of protective action due to the binder itself has also been recognised. According to the nature of the pigment or the binder, the main protective function may be due, therefore, to either the one or the other. In systems based on linseed oil, it is the pigment; in synthetic combinations, it is the binder.

The former I.G. at Hoechst Works aimed at developing a lead-economising pigment and solved the problem in 1929 by showing that lead cyanamide was a most effective anti-rust pigment. It is produced by precipitation and is a lemon yellow, microcrystalline pigment. It is extremely voluminous and has a needle structure. Its specific gravity is of the order of $6{\cdot}2 \pm 0{\cdot}1$. Lead cyanamide was described for the first time in 1874, by Drechsel; its chemical composition is PbCN2.

Lead cyanamide is an active anti-rust pigment, along the lines described. It consists of a bivalent lead compound and has the faculty of transforming acidic atmospheric products, such as carbon dioxide, sulphur dioxide, hydrogen sulphide and the acid decomposition products of linseed oil, into non-corrosive compounds. The cyanamide split off under the influence of acid, due to its tendency to form ammonia, has an alkaline passivating action with water, which is of extreme importance. Lead cyanamide made into a paste with water has a *p*H of 9-11. Its alkaline passivating capacity remains unimpaired over many years (proved by Jordan* after six-and-a-half years.)

The low specific gravity already mentioned and the great bulking volume due to the crystal structure, confer valuable technical properties upon ready mixed paints. There is practically no settling in the paints, whilst, in spite of ready soap formation, lead cyanamide, when incorporated in paint, shows practically no tendency to thickening, the reaction not beginning until oxygen has access to the applied coat. All lead cyanamide paints, including those extended with other pigments, are easily brushable, which makes for good applicability and excellent coverage, at the same time reducing time and labour requirements. Lead cyanamide paints not only possess good hiding power, but have owing to their easy brushability and high bulking volume, a high spreading rate. It is a well-known fact that the spreading rate of a paint given equal binders depends largely on the volume taken up by the paint and its behaviour when being applied. The ready-mixed lead cyanamide paint has a specific gravity of only 1·8 to 2. Comparing equal thicknesses of coat, it follows that this larger volume makes for greater coverages. Owing to its high bulking volume lead cyanamide when being made into primers requires what appears to be a relatively high quantity of oil. However, as a correspondingly larger spreading rate is

* Korrosion u Metallschutz, 1944, **20**, 215: New developments in protection by painting.

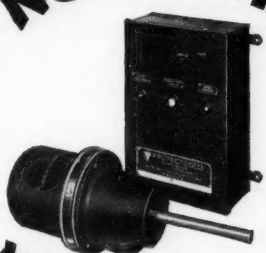
reached with this than with normal paints, the quantity of oil used per sq. m. in the end works out at the same figure.

The lead cyanamide coating is practically dry throughout after seven days. Particularly noteworthy is its high elasticity notwithstanding its great hardness, a very important property which was found in all paints and coatings compositions pigmented with lead cyanamide. The hardness tests by the Clemen-Keyl method show the greater elasticity of lead cyanamide films very clearly. Shavings of the film removed in the test remain intact when lifted even after a prolonged period of observation, which is a sign of very small tendency to brittleness. Connected with this property are high adhesive power and extensibility, which were measured in collaboration with the Varnish Section of the Farbenfabriken Bayer, Uerdingen Works. The above are very notable properties of the lead cyanamide films, since the specific requirements for rust protection are non-porous and resistant coats, which nevertheless remain sufficiently elastic so that they do not crack when stressed, as for example when used on riveted steel structures.

Paint films containing lead cyanamide, as a result of the great reactivity with oil and other media containing oil, generally dry very rapidly, and by using suitable driers, the drying time may be considerably speeded up. Speeding up of drying time is obtained also with tung oil to 5 per cent. without measurable brittleness of the paint, lead cyanamide paints in alkyd resins are characterised by short drying times and good brushability. Similarly, all activated grades of linseed oil blend very well with lead cyanamide, securing complete dust-free drying within 20 min.

A special quality of lead cyanamide was apparent when it was used under top coats which dried solely by solvent evaporation—bitumen, and certain synthetic resin and plastic varnishes. The pigment may be used in oil media beneath such coatings without having to wait any appreciable time before applying the top coat. It is very difficult to give a theoretical explanation for this remarkable property of lead cyanamide, but practice has shown that

NO FLAME



Protectoglo Flame Electrode and Control Relay

NO FUEL FLOW

and therefore NO DANGER OF EXPLOSION because the PROTECTOGLO Combustion Safeguard System gives instantaneous automatic protection to workers and plant.

Designed to stop ***instantaneously*** the flow of gas to a burner in case of flame failure, and to give ***continuous protection against grounding of the flame electrode,*** the Honeywell-Brown Protectoglo Combustion Safeguard System is installed on gas-fired furnaces, kilns, ovens, lehrs, etc. throughout the country. Push-button control, electric ignition, and flexibility of design to permit incorporation of temperature or limit controls if required, are some of its outstanding features. Please write for details of an installation to suit your particular requirements.

HONEYWELL-BROWN
ADVANCED INSTRUMENTATION

HONEYWELL-BROWN LIMITED
1 Wadsworth Road, Perivale, Greenford, Middlesex
Works: Blantyre, Lanark, Scotland.

Affiliated companies:
AMSTERDAM, BRUSSELS, PARIS, STOCKHOLM, ZURICH

lead cyanamide/oil primers may be coated immediately after drying with, for instance, bitumen and that the primer will continue to harden perfectly throughout, developing good adhesive power. As special protective qualities are expected of lead pigments, with which soap formation occurs in conjunction with an oil, priming, insofar as lead pigment primers are used, should be done with a medium consisting of or containing linseed oil. Lead cyanamide offers the possibility in this connection of reducing very materially the drying period necessary before nearly air-impermeable top coatings can be applied.

In 1950 the German Federal Railways included lead cyanamide paints in their technical specifications. These further contain specially recommended extenders.

Lead cyanamide is miscible with all inert pigments. It has a suspending effect on pigments which settle easily, and may be combined with all the usual binders. Tests have been made with alkyd resin products, alkyd resin, and chlorinated rubber/oil combinations, and with binders with a vinyl resin.

Apart from being used in priming paints, top coats, special primers for railway carriages and coach building, lead cyanamide is also used in knifing fillers, instead of white lead, where the advantages of lead cyanamide as an active rust-protective pigment are obvious. In top coats, there is a considerably higher safety margin against rust.

The Duisburger Kupferhutte have for the last two years been using lead cyanamide/micaceous iron ore finishing paints.

Lead cyanamide/micaceous iron ore combinations were chosen which corresponded to the German Federal Railways specifications for white lead/micaceous iron ore paints, substituting lead cyanamide for white lead. There was also a combination in which the micaceous iron ore had been replaced by Silcar. In making up these micaceous iron ore/lead cyanamide top paints, a further important property of lead cyanamide was recognised, namely that its addition improves the settling properties. There is no thickening and such settlement as occurs is easily redispersed by stirring.

Brushability, as compared with the well-known white lead/micaceous iron ore paints, is very good; the resultant coats are smooth and matt.

Lead cyanamide is now available in England and paints formulated with it are obtainable from several of the leading paint manufacturers.

Research on Paints at South African Coast.—The Paint Industries Research Institute at Howard College, Durban, is to carry out research into the problem of preventing salt water corrosion at the coast.

Mr. G. M. Hamilton, director of the Research Institute, and formerly chief research chemist to a British cable company, says that there is wide scope for paint research in the Union and that the Institute will concentrate on problems facing paint producers and users.

It was estimated in 1922 that corrosion of iron and steel resulted in a world loss of £700,000,000 a year. The loss would be about treble that amount today.

South African Aircraft to be Coloured White.—According to a recent issue of *Railway News*, South African Airways' aircraft—"the Blue and Silver fleet'—are to be coloured white instead of silver on their top surface, in order to decrease cabin temperature. Experiments overseas have proved that temperatures can be reduced 12 to 15 degrees by using a glossy white colour.

Experiments carried out by South African Airways on the route to South-West Africa showed that cabin temperature was lowered by as much as 20 degrees at ground stops.

Constellations flying on the route to London will receive priority for painting.

South African Paint Exports.—South Africa is now exporting paint to the Near East and the Far East, as well as to other African territories, and, in fact, has built up a substantial export business, said Mr. T. H. Howard, chairman of the South African Paint Manufacturers' Association, in Johannesburg recently.

With the aid of the Paint Industries Research Institute, a joint venture of the Council for Scientific and Industrial Research and the paint industry, South African-made paints had established a reputation for quality equal to any of the older-established industries in other countries.

AS USED BY LEADING MANUFACTURERS

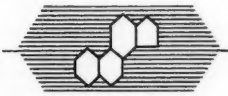
WALTERISATION
Regd. Trade Mark
QUALITY PHOSPHATE RUSTPROOFING

FOSCOTE
Regd. Trade Mark
DESTROYS RUST

AGENTS
STOCKISTS &
DISTRIBUTORS
THROUGHOUT
THE WORLD

DERAN
Regd. Trade Mark
REMOVES RUST

THE WALTERISATION CO. LTD
PURLEY WAY, CROYDON, ENGLAND
Telephone: Croydon 2791
Telegrams: Rustproof Croydon

CRODA  GOOLE

Have you considered our

LOWERITE No. 3

STRIPPABLE SPRAY BOOTH COATING ?

It saves time and money in Spray Booth cleaning

Croda Limited
CRODA HOUSE · SNAITH · GOOLE · YORKS · ENGLAND
TELEPHONE SNAITH 77, 78 and 79
ALSO AT LONDON · NEW YORK · MANCHESTER · BRADFORD

British Standard for Packaging Code

DURING the war most manufacturers of engineering equipment and spares were required to protect them against corrosion during transportation, in many instances overseas, as well as during storage, and B.S.I. published Section 3 of B.S.1133 "Packaging Code," to provide assistance at that time. Some firms have continued to apply the temporary corrosion preventives to ordinary commercial goods, but many abandoned this procedure after the war, not recognising that the need still remained to ensure that equipment remains in a good state from the time of manufacture to usage.

The disappointment and frustration engendered when goods received overseas have rusted in transit can easily be imagined, and yet there is still a considerable failure to safeguard engineering equipment exported. Perhaps because many items, particularly mass-produced parts, are used relatively quickly when not exported, there has been a more persistent failure on the part of some manufacturers to realise the considerable deterioration that can occur during transit and during storage in this country. Goods in wagons or on lorries are often not protected against rain or they are put into contact with damp wood; this is mainly a packaging problem, but corrosion prevention is also necessary. In storage it is often impossible to provide good conditions; industrial atmospheres are usually corrosive, unheated stores are common, large articles and equipments often have to be stored outside, spare parts may have to be kept for several years before they are wanted, and so on. Corrosion preventives that can easily be removed when an article is fitted (the so-called "temporary corrosion preventives") are widely used in some works and are freely available from a considerable number of manufacturers. What is required is a wider recognition of the need for them, the setting up of standards of performance, and guidance on their suitability for particular exposure conditions and types of articles, on the supplementary wrapping and packaging that individual materials require, and on relative costs. The British Standards Institution has recently issued Section 6 of the Packaging Code B.S.1133 to provide this information.

This Section 6 of B.S.1133 is an adaptation of the war-time Section 3 to ordinary commercial practice. Whereas the former edition referred extensively to Government Department specifications, performance specifications for the temporary corrosion preventives have been formulated in the present edition. The general scope remains broadly the same as before: not only are temporary corrosion preventives and their uses described in detail, but the essential preliminary conditions are catered for by an extensive section on cleaning (covering all the well-established methods of dealing with oil, grease and dirt and including the removal of rust and scale) and a short section on drying.

The document has been carefully prepared in order that it shall serve the dual purposes of a directly readable handbook on the subject and a reference book.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 24 Victoria Street, London, S.W.1. Price 10s. 6d.

General and Industrial Paints Ltd.—The nominal Share Capital of this private limited Company has been increased to £250,000. Mr. F. W. Burmann has been appointed Chairman. General Sir Hubert Gough and Mr. Norman Bartleet have retired from the Company's Board. Mr. E. W. M. Fawcett, M.A., B.Sc., until recently Deputy Director and Manager of Research at the Paint Research Association's Teddington Laboratories, has joined the Board of the Company and has been appointed Technical Director.

The Board of Directors consists of the following: F. W. Burmann (Chairman and Managing Director), A. G. Jordan (Assistant Managing Director), H. Wylie, C.A., E. W. M. Fawcett, M.A., B.Sc.

The Company's Secretary is Mr. G. D. Palmer, F.S.C.

Polythene Film in the U.K.—Imperial Chemical Industries Ltd. and the Visking Corporation of Chicago, U.S.A., are proposing to form a joint company in Great Britain to manufacture polythene film. At the request of the U.S. Government during World War II the Visking Corporation developed a process for manufacturing unsupported packaging film from polythene. Subsequently, they have developed a large market for this product which is sold under the trade name of "Visqueen." Polythene, which was discovered in I.C.I. laboratories in 1933, is sold by I.C.I. under the trade name "Alkathene." I.C.I. also pioneered its manufacture in film form in Great Britain.

FUEL ECONOMIST

EDITORIAL DIRECTOR: W. F. Coxon, M.Sc., Ph.D., F.R.I.C., F.I.M., M.Inst.F.

fortnightly

EDITORIAL CONTENT

Primarily to encourage efficient fuel usage based on practical considerations.

KEY POINTS

★ High efficiency solid fuel appliances.

★ Adaptation as to existing houses.

★ Economy benefits of correct insulation.

★ Parliamentary reports.

Coal, coke, smokeless fuels, gas, electricity, and oil are all covered —emphasis is on the user's needs.

READERSHIP

Housing and factory architects; Local government Officers; Fuel engineers; builders' merchants; Government officials and informed public opinion. Manufacturers and distributors of fuel appliances and equipment used in fuel economy.

ARROW PRESS LTD., 157 HAGDEN LANE, WATFORD, Herts.
Phone: Gadebrook 2308 Grams: Techpress, Watford

25/- per annum

TAILOR-MADE INFRA-RED UNITS

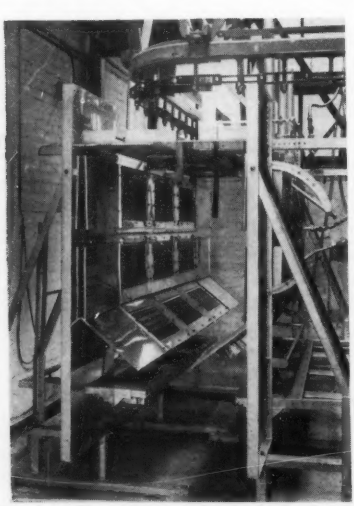
THE firm of Thomas De la Rue and Co. Ltd., pioneers in this country of gas-fired industrial infra-red equipment, have always advocated that infra-red equipment should be tailor-made to suit the work for which it is required.

In order to ensure that the proposed design is correct they have now opened at Kenilford Road, Balham, S.W.12, an infra-red research station fully equipped with spray booths, conveyorised infra-red drying ovens, test equipment, etc., and here it will be possible for samples of a maker's product to have the proposed finishing material applied and stoved in the test oven. As a result of these tests, stoving times can be determined, and the production oven built to suit the profile of the job.

The experimental ovens fitted at the Balham Research Station have been designed to give the utmost flexibility of shape and heat control, and this, coupled with infinitely variable conveyor speeds, ensures that time cycles can be determined on the actual article to be processed. It has long been recognised that in an application where drying times have been reduced to minutes, experimenting with the actual medium to be used without applying it to the article to be finished, is apt to give a misleading picture. With the adjustable tunnel, however, a high degree of accuracy can be given to such experiments, for articles as physically diverse as a fully assembled tractor or a 4-gal. "jerry can" can be successfully stoved with equal facility and, in each case, because of the convertibility of the oven, the greatest flux density possible may be brought to bear upon the materials. Time cycles can, therefore, be accurately gauged and seconds thus saved make an appreciable contribution, calculated over a year, to outputs on large production lines.

Any manufacturer who is desirous of investigating the possibilities of infra-red process drying in solving his drying problems can now send his product to the Research Station.

Close co-operation with paint manufacturers is being established and will be maintained in order that all possible technical assistance is available to the Industrialist.



End view of the large conveyorised experimental tunnel showing one of the many shapes to which it can be adjusted

BOOK REVIEW

"OXIDATION of Metals and Alloys," by Dr. O. Kubaschewski and B. E. Hopkins, M.Sc., principal scientific officers at the National Physical Laboratory. Butterworths Scientific Publications. Price 35s.

THE main object of this book is to give an appraisal of the state of research on the oxidation of metals and alloys at temperatures of about 100° C. and above. In recent years developments of immense technical importance have been made in this field, but until now the evidence has been widely disseminated in a mass of unsifted and uncorrelated literature.

Since there is no single theory of oxidation, the book gives an account of the ideas that have been put forward to explain various aspects, indicates the extent to which existing theories appear to be adequate, and deals in detail with the major experimental results which have to be accounted for on a theoretical basis.

The point of view from which the book has been written is not that of a theoretical scientist, nor that of the production scientist, but rather from an intermediate standpoint. It will thus satisfy the needs both of those more immediately concerned with the fundamental aspects of oxidation, and those whose interests lie in the application of scientific principles to practical ends.

AUTOMATIC VITREOUS ENAMELLING

WE have details sent to us by Controlled Heat and Air Ltd. of Smethwick, Birmingham, of a recently developed plant for the processing of vitreous enamelled parts at the Richmond Gas Stove Co. Ltd., works, Birmingham. It comprises a laydown conveyor and incorporated in one straight line are automatic spraying section, edge spraying booth, radiant heat drying section and enclosed brushing section, the whole plant being coupled to a highly efficient dust collector.

The only parts of the unit not enclosed are the actual loading and unloading sections.

The parts are loaded on to the conveyor which has special supports to carry the various shapes and sizes of vitreous enamel ware. The parts are conveyed firstly through the automatic spraying booth, this booth incorporating a specially designed reciprocating head fitted with four spray guns, the speed of reciprocation being adjustable to give absolute uniformity of coat thickness. 50-gal. pressure pots are coupled in tandem adjacent to the booth for ease of operation. From the automatic spraying booth the parts pass into the edge spraying booths, and operators working either side of the conveyor complete the spraying operation.

In both spraying sections the parts are perfectly flat on the conveyor and the extraction system has been designed to assist in keeping the parts in position during spraying. The exhaust air is extracted from below the level of the conveyor which tends to hold the parts firmly on their supports. Uniformity of coating is thus ensured.

Since the angle of spraying is downwards and the extraction from beneath the work, this ensures that the upper part of the booth remains more or less clean.

After spraying operations the parts pass into a heated section for drying and this section incorporates twenty-four Bratt Colbran infra-red units operating in the horizontal plane along the conveyor—Fig. 1.

Each unit is a completely tooled job so that every part is interchangeable and, therefore, replaceable. Its construction is such that a maximum strength and rigidity is obtained with minimum weight and the dimensions are 27 in. long by 13⅜ in. wide by 5 in. deep. The gas consumption of each unit is 25 to 30 c. ft. per hr., depending on requirements

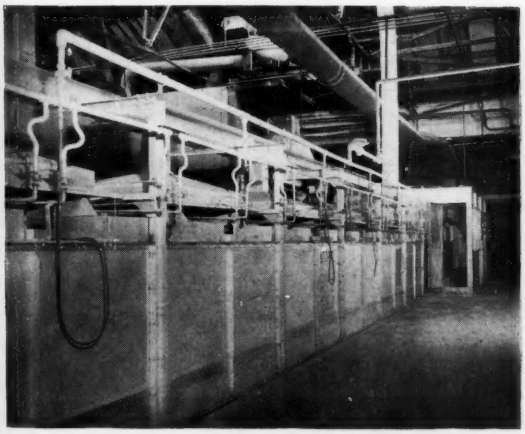


Fig. 1. Parts pass through a heating section incorporating 24 Bratt Colbran infra-red units in the horizontal plane.

Fig. 2. The enclosed brushing section in which operators, on both sides of the plant, finish off parts as they pass on the conveyor

and is connected to the 1½ in. B.S.P. governed gas main by an independent ⅜ in. B.S.P. gas supply to each burner which normally operates at ·7 in. W.G. Under normal conditions the panel face temperature of the unit is 650° F., which is variable by means of pressure adjustment on the governor. Connected to the infra-red units is a short flue spigot and the hot products of combustion are ventilated into a series of extract hoods where they are collected and delivered back into the working space underneath the conveyor, before discharging to atmosphere. This has considerably increased plant efficiency. Drying time is approximately 2½ min.

The dried parts are then carried by the conveyor into the enclosed brushing section—Fig. 2. Here the operators, working either side of the conveyor, brush and finish off the parts as they are carried past them. This section also incorporates extraction equipment of such a capacity that the atmosphere in the enclosure is comfortable for the operators, and also really efficient extraction. The whole equipment has been designed for easy cleaning.

All extraction equipment is connected to a C.H.A.L. Max Fabric single lane, two-tier, three-section type collector, having 150 rectangular bags giving a total filtering area of 3,600 sq. ft. This means that when handling a volume of 9,000 c. ft. of air per min. the speed through the fabric is 2·5 ft. per min.

Owing to the unique shape and arrangement of the bags, it has been possible to incorporate a really efficient motor-driven shaking gear.

The filter is designed to operate on the suction side of the fan with the result that the fan handles only clean air and wear and tear of the fan is eliminated.

Production figures of the plant working at an average speed of 14 ft. per min. are as follows:

Component	*Area of component*	*No. of pieces per min.*	*Area per min.*	*No. of pieces per hour*	*Area per hour*
Panel	2·243 sq. ft.	7	15·7 sq. ft.	420	942·06 sq. ft.
Crown tray	2·01 „ „	14	28·14 „ „	840	1688·4 „ „
Splash Plate	3·06 „ „	14	42·84 „ „	840	2570·4 „ „
„ „ 8″	1·25 „ „	21	26·25 „ „	1260	1575·0 „ „
Outersides	3·41 „ „	10	34·1 „ „	600	2046·0 „ „

AMERICAN TRADE NEWS

Salt Spray Cabinet

THE new Lucite Salt Spray Testing cabinet for "fog type" spray testing of all ferrous and non-ferrous metals, organic and inorganic coatings, is regarded as a major advance in electro-chemical equipment.

The cabinet is said to be inert to all solutions and gases used in the complete range of this type of testing, and will last indefinitely in continuous service.

The advantages include:

Greater versatility, longer life at approximately half the price of conventional commercial types, many times lighter in weight, transparent for observing operations, and it is claimed to be a better insulator for maintaining accurate operating temperatures.

Washing Machine

A special washing machine has been designed to remove grease and chips from rocker arm shafts after machining operations, and it has been engineered for one of the largest automobile manufacturing plants in the U.S.A.

A unique feature is the special type of Bar Conveyor Unit equipped with steel discs upon which the shafts ride. The discs not only hold the shafts in place as the conveyor moves through the machine, but also provide minimum points of contact. The maximum surfaces of the shafts thus are exposed for fast efficient washing and drying. The shafts pass through consecutive high-pressure fan-shaped curtains of cleaning solution from above, below, and both sides. Drying is effected by means of a hot blow-off unit.

The machine is equipped with two screens so that one screen may be removed at a time for cleaning. The screen tank screens out particles from the cleaning solution to prevent the nozzles becoming clogged.

Metal Spray Gun

This new model is designed to spray a wide range of low melting alloys and metals. In addition to the internal heating element, a nozzle heating element prevents metal coating at the nozzle and assures continuous uniform spraying. It is believed this gun will provide the answer to those marginal alloys in the 500-650° F. which have been difficult to spray. The gun is suitable for intermittent or production spraying.

Surface Finishing Machine

This machine was developed for finishing formed decorative name plates for refrigerators, stoves, appliances and automobile trim.

Through a vacuum clutch arrangement it will handle name plates made of brass, copper, silver, plastic, aluminium, wood and other non-magnetic materials. Small items can be held and surface-finished without interference with coverage over the entire surface. All controls have been assembled at a central control panel which is situated where it will not be exposed to abrasion from the polishing compound.

The work-table consists of a perforated plate mounted over a sealed air space and this space is connected to a vacuum pump.

Black Finish

A new jet black finish for iron and steel is claimed to have ten times the corrosion resistance of conventional blacks. It may be used in water solution at low temperatures, and parts are immersed for 10-15 min., rinsed and dried. After oiling or waxing, the black durable finish is ready for service.

Advantages claimed are:

Non-caustic processing bath, easy to build and control, operating temperatures lower than other widely used "black" processes, any part capable of immersion may be treated, and the process is suitable for machined or threaded parts.

New Cold Galvanic Process

Two years of intensive testing has developed an entirely new method of cold galvanizing for surface protection of steel and iron.

The compound may be applied by brush, spray, or cold dip. Special equipment or training is unnecessary. It is claimed to differ basically from other metallic paints containing zinc. It actually combines with the base metal setting up electrical continuity and offering true cathodic protection. It leaves a coating of ninety-six parts by weight, of chemically pure zinc.

Advantages claimed are:

When applied to rusted surfaces it stops further rusting and prevents "rust creep," eliminates dismantling of machinery, a single coating will give approximately 625 sq. ft. coverage per gallon, it is tack-free after 40 min., and the dried film is not injurious to health.

Properties of Electrodeposited Nickel

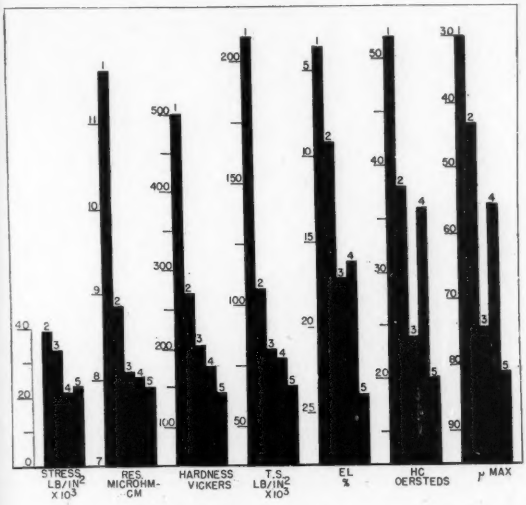
A MUCH clearer picture of the effect of plating variables on the structure and properties of electrodeposited nickel has resulted from a comprehensive laboratory investigation conducted over the past five years by Victor Zentner, Abner Brenner, and Charles Jennings of the U.S. National Bureau of Standards. In the course of the study, which was sponsored by the American Electroplaters' Society, cathode current efficiencies and the internal stress of the deposits were determined for a great number of different bath compositions and operating conditions, the chemical composition and microstructure of the deposits were investigated, and their thermal and mechanical properties were measured. The results show that hardness, tensile strength, and other properties of nickel deposits can be varied over a wide range by proper choice of plating bath. Moreover, it has been possible to explain this broad variation in properties on the basis of the physical nature of codeposited impurities present in small amounts.

Industrial use of nickel plating includes a variety of applications. In general, the thinner coatings are used for ornamental purposes or for protection against corrosion, while the heavier deposits are applied to machine parts, where resistance to wear is an important factor, and used in electroforming. Although quite different properties are required in different applications, until now little information had been available regarding the relationship between the conditions under which the plating is done and the resulting deposits. The present investigation provides a large amount of basic data which can now be utilised for the consistent production of deposits having desired properties. While major emphasis was placed on those mechanical properties of the deposits which are of immediate value in engineering applications, data were also collected on electrical and other properties which may be of value in determining the suitability of nickel deposits for special applications.

In the Bureau's study, about 240 different deposits were produced from twenty different types of baths operated over a wide range of temperature, current density, and *p*H. The test specimens were obtained by depositing nickel on sheet or tubular cathodes to a thickness of about 0·01 in. During the plating process, current efficiencies and internal stress of the deposits were measured. After separation from the cathodes, the specimens were analysed chemically, and their structures were studied by optical microscopy, electron microscopy and X-ray diffraction. They were also tested for hardness, tensile strength, elongation, yield strength, Young's modulus of elasticity, fatigue limit, internal friction, thermal expansion, specific heat, heat of solution, electrical resistivity, and magnetic properties. The effects of heat treatment on many of these properties were studied.

It was found that the most important factor affecting the properties of the deposits is the type of plating solution, that is, the nature of the anion and the presence of special additives. Although deposits produced at lower temperatures were usually finer-grained than those obtained at high temperatures, the effects of variations in operating conditions, such as temperature and current density, are in general relatively small, provided the conditions are within the satisfactory operating range for the solution used.

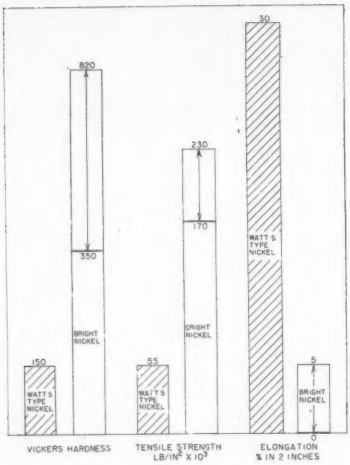
On the basis of the physical and mechanical properties of the deposits, nickel plating baths may be classified in three main groups: *bright-nickel* baths, containing organic brighteners; *high-chloride* baths, containing more than 50 per cent. of the nickel present as chloride; and *Watts-type* baths,



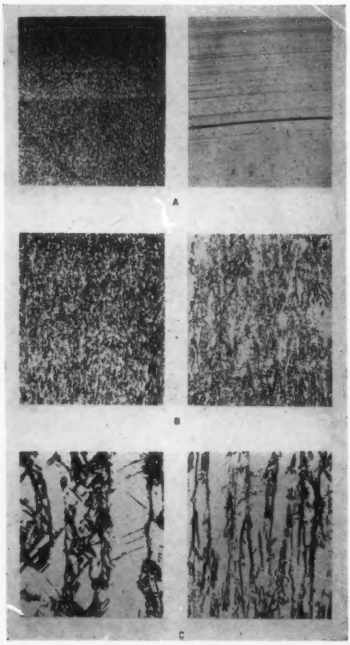
Block diagram summarising physical properties of nickel deposited from five different types of plating baths. 1: bright-nickel bath. 2: high-chloride bath. 3: bath containing half the nickel as chloride and half as sulphate. 4: sulphate bath. 5: Watts-type bath

Electron micrograph showing the crystal structure in electrodeposited nickel from a Watts-type plating bath. This micrograph was obtained by transmitting an electron beam through nickel deposited as a film one-millionth of an inch thick (x 27,750)

which contain the nickel in the form of both sulphate and chloride in the ratio of 3:1. In general, the extremes in properties are shown by the bright-nickel and the Watts-nickel deposits while the properties of the high-chloride nickel are intermediate between the two. The bright-nickel bath yield bright deposits having the greatest hardness, tensile strength, resistivity, and coercive force of all types of nickel deposits, but they also have the lowest ductility, elongation, and magnetic permeability. The high-chloride baths, on the other hand, produce dull deposits which are somewhat below bright nickel in hardness and tensile strength, but have a higher



(Block diagram) Graphical comparison of the mechanical properties of nickel deposits from Watts-type and bright-nickel plating solutions. The arrows show the range over which the bright-nickel deposits vary



Microstructure of typical nickel deposits obtained at the U.S. National Bureau of Standards from bright-nickel plating baths (A), high-chloride baths (B), and Watts-type baths (C). In general, it was found that the more fine-grained deposits (A) have greater hardness and tensile strength (x 125)

ductility. From the Watts-type baths are obtained dull grey deposits. These are the purest of the three types; they possess the lowest stress, hardness, tensile strength, resistivity, and coercive force, and at the same time the highest ductility, elongation, and magnetic permeability.

The properties of the deposits were affected very little by the concentration of nickel in the plating solutions. However, the effect of the chloride content of the bath on the hardness of the deposit was rather striking. When a bath containing one-fourth of the nickel in the form of chloride and the rest as sulphate was used, a pronounced minimum in hardness of the deposit was observed. As yet, no explanation for this effect has been developed.

In its influence on the mechancal properties of the deposits, the *p*H of the plating solution was second in importance only to the nature of the bath constituents. In the *p*H measurements, it was found that when the *p*H of the bath goes above 5, the tensile strength of the deposit rapidly rises and the ductility decreases. If the *p*H of the solution is made high enough, there is a marked increase in hardness and tensile strength and a decrease in elongation. However, these extreme properties are accompanied by such a great increase in stress that the deposits are likely to crack spontaneously or exfoliate.

The microstructure of the deposits was rather closely correlated with their observed properties. Thus, in micrographs of nickel deposits from baths of varying chloride content, the most coarse-grained deposit had the lowest hardness. In general, deposits with coarse-grained structures contained relatively small amounts of impurities and were soft, ductile, and low in tensile strength. On the other hand, deposits with either fine-grained structures or no visible grain structures contained a relatively large amount of impurities and were strong and hard but not very ductile.

Heat treatment was found to have a much more pronounced effect on the mechanical properties of bright nickel than on those of Watts nickel. Thus, after heat treatment at 400° C., the tensile strength of bright nickel fell from about 200,000 lb./in.^{2} to about 20,000 lb./in.^{2} By contrast, the tensile strength of Watts nickel decreased by only 15,000 lb./in.^{2} from an initial value of 75,000 lb./in.^{2} A comparison of the microstructures of the two types of deposits shows large clean grains in the Watts nickel, while the bright nickel deposits have dark areas which may indicate either inclusions or voids.

On the basis of the data obtained in the investigation, it appears that the widely varying properties shown by electrodeposited nickel are determined primarily by the chemical and physical nature of codeposited impurities—usually small quantities of oxygen, hydrogen, carbon, or other elements present in small fractions of a per cent. This is shown not only by the parallel trend in the variation of many of the properties, indicating a common basic cause, but also in the correlations found between properties and crystal or microstructure and in the pronounced dependence of the properties on bath composition. Because large changes in the deposits result from the presence of certain types of ions or minute amounts of special additions to the plating bath, it is reasonable to assume that the distinctive character of the deposits is caused by the codeposition of various kinds of foreign matter which may vary in quantity as well as in effectiveness. The codeposited material may sometimes influence the properties of the deposit directly; in other cases, it may result in a fine-grained structure, perhaps, with lattice distortion and internal stresses, which in turn affects the physical and mechanical properties of the deposits.

In general, it would seem that substances present in the plating solution affect the properties of the electrodeposit only to the extent that they influence the codeposition of foreign material. Thus, the great differences in the properties of bright-nickel and Watts-nickel deposits can be ascribed to impurities in the bright nickel derived from the organic additives used to produce the brightening. In fact, the Bureau's analysis of the bright-nickel deposits showed that they contained carbon and sulphur inclusions totalling about 0·1[2] per cent., whereas the Watts-nickel deposits did not contain these impurities. On the

other hand, some of the variations in the mechanical properties of the Watts-nickel deposits can be attributed to the presence of small amounts of oxide. For example, a good correlation was found to exist between the mechanical properties of Watts-nickel deposits and their oxygen content.

It thus becomes apparent that those electrodeposited coatings that are of value in industry are not pure coatings, but owe their valuable properties to the presence of small amounts of impurities. The smooth, thick electrodeposits used by the plating industry are actually exceptional inasmuch as the pure metals would be deposited as a mass of large crystals rather than a coherent layer.

The mechanism by which foreign material is codeposited with nickel is a matter of speculation, but the present study indicates that it is probably an adsorption phenomenon rather than an electrochemical one, as has sometimes been postulated. The adsorption hypothesis is sufficiently versatile to explain the very specific effects of certain additives and the influence of the anion of a plating solution on the nature of the deposit. Some substances, instead of being directly adsorbed, may so modify the *p*H of the cathode film that basic compounds are codeposited with the metal. Further research is needed on adsorption phenomena and the processes taking place in the cathode film during electrolysis.

More precise methods of analysis will be required in order to correlate the content of foreign material with lattice distortion and crystal structure.

Correspondence

The Editor, INDUSTRIAL FINISHING.

re: Spray Silvering

DEAR SIR,—It occurs to us that readers of the article by Messrs. Upton, Soundy and Busby which appears in your January issue may like to know that we developed a special spray gun for this kind of work several years ago. It is now one of our standard products commanding steady sales.

The gun consists of two entirely separate atomising systems controlled by a common trigger assembly and we shall be glad to give additional information to anyone who is interested.

Yours faithfully,

AEROSTYLE LTD.,
F. B. P. RAMBRIDGE.

Aerostyle gun for spraying chemical combinations to mix in atomised spray: Silver nitrate; formaldehyde; etc.

The Editor, INDUSTRIAL FINISHING.

Finishing Machine Tools

DEAR SIR,—Wide publicity has been given both in the Press and by the B.B.C. to the recommendations of the British Productivity Council in their Report on Machine Tools, particularly that which proposes the cheapening of machine tools by reducing the quality of the finish. It should, therefore, be as widely realised that it is essential for machine tools to be well-finished, for the following reasons:

1. That the finish protects the tool against corrosion, etc., and therefore prolongs its life.
2. That a smooth paint finish and bright polished plated ware enable the machine to be kept clean and therefore to produce better work.
3. That a well-finished machine has a psychological effect on the operator who

takes more care of it, increasing its useful life and also producing a better product.

4. That in any market a shoddy finish is likely to give the impression of a poor machine and the chances of a sale in competitive markets would be correspondingly reduced.

The recommendations on page 49 of the Report that a return should be made to war-time finish, e.g., a coat of grey paint on an unfilled casting, would be likely to have serious repercussions on our export trade in particular (amounting to over 40 per cent. of British production); furthermore, it would adversely affect the useful life of the machine and probably its productive power. While such measures were necessary during the war, to revert to them in peace time would most certainly not be in the national interest.

S. WERNICK, *Hon. Secretary*,
Institute of Metal Finishing.

SPECIAL COURSE ON CORROSION TESTING

THE Northampton Polytechnic are arranging a course of lectures on the subject of corrosion testing; the first will be given on Wednesday evening, 18th March, and the others on Tuesday evenings, as listed in the following programme. We are advised by the head of the department of applied chemistry, J. E. Garside, Ph.D., M.Sc.Tech., F.R.I.C., F.I.M., that the department considers it essential to make further efforts to explain, not only the mechanism of corrosion, but the methods of testing metals for corrosion resistance; the lectures have been arranged with this end in view.

Lecture 1.

GENERAL PRINCIPLES OF CORROSION TESTING.

Lecturer: S. C. Britton, M.A. (Tin Research Institute).

Corrosion processes, the factors limiting their speed and types of damage that they produce. The aims of corrosion testing and the choice of means to attain them. The distinction between tests to assess service life and acceptance tests.

Lecture 2. *Tuesday*, 24*th March*.

THE PREPARATION OF SPECIMENS.

Lecturer: F. A. Champion, Ph.D., A.R.C.S., F.I.M. (The British Aluminium Co. Ltd.)

The selection, replication, identification and general preparation of specimens. The cleaning of specimens for examination.

Lecture 3. *Tuesday*, 14*th April*.

THE ATMOSPHERIC CORROSION OF UNCOATED METALS.

Lecturer: J. F. Stanners, B.Sc. (British Iron and Steel Research Association).

Conduct of outdoor tests—Selection of site. Influence of humidity and pollution. Methods of assessing corrosion.

Laboratory and accelerated tests—The intermittent spray test. The A.R.D. seawater droplet tests. The C.R.L. sulphur dioxide test. Accelerated outdoor tests.

Service trials—Steel sleepers. Coal wagons.

Lecture 4. *Tuesday*, 21*st April*.

THE IMMERSED CORROSION OF UNCOATED METALS.

Lecturer: G. H. Botham, B.Sc., F.R.I.C. (The A.P.V. Co. Ltd.)

Environmental factors to be considered in laboratory tests. Apparatus used in laboratory and field corrosion testing. Special corrosion tests.

Lecture 5. *Tuesday*, 28*th April*.

TESTS FOR THE SELECTION OF PROTECTIVE COATINGS.

Lecturer: S. C. Britton, M.A. (Tin Research Institute).

The properties required in metallic and non-metallic coatings and their assessment by field and laboratory tests. Accelerated corrosion tests, their uses and limitations. Acceptance tests, including estimation of thickness and porosity.

Lecture 6. *Tuesday*, 5*th May*.

THE ASSESSMENT OF CORROSION.

Lecturer: F. A. Champion, Ph.D., A.R.C.S., F.I.M. (The British Aluminium Co. Ltd.)

Choice of testing method. Visual, microscopic, gravimetric, mechanical, electrical and optical examination of specimens. Gasometric and analytical methods of assessment.

The fee for the Course is 20*s*.

Enrolment can be effected either by personal attendance at the Polytechnic or by post. Those enrolling by post should enclose the fee, a stamped envelope and the following information:

(i) Name and address.
(ii) Name of employers.
(iii) Qualifications, e.g., B.Sc., Higher National Certificate, etc.

Rollers Accelerate Finishing

by THOMAS A. DICKINSON

MECHANISED rollers developed by L. R. Wallace and Co. of Los Angeles have greatly accelerated the process of applying numerous types of organic finishing materials on sheet or plate surfaces—including paper, wood, glass, plastics, metal, textile, and many related products.

The rollers in essence are neoprene-covered steel cylinders, aligned one over the other in a horizontal plane, and their purpose is to transfer coating materials to one or two surfaces of a product passing between the two units as they are electrically rotated. Small doctor rolls, adjacent to the two main coating rolls, retain liquid finishing materials so that the latter will be uniformly applied as coating films by the rotating neoprene surfaces; and the space between the main coating rolls is adjustable in accordance with the thicknesses of the materials to be finished in different circumstances.

Materials to be finished may be manually or mechanically fed into the space between the coating rolls, and finishing compounds may be continuously applied to as many as 15,000 sq. ft. of surface hourly.

Relatively small quantities of solvents or thinners are required in many circumstances, since extremely viscous materials can be used as roll-coating solutions, and losses of finishing compounds are negligible—as evidenced by the fact that a gallon of enamel may be used to cover 850 sq. ft. of a deposition surface.

Where the coating equipment was properly adjusted prior to finishing operations, the only defects that have thus far been encountered were attributable to improper surface preparations or the careless handling of materials prior to the solidification of applied coatings.

Coating rollers and accessories are mounted on a portable structural steel frame, and mechanical rotations for most finishing purposes have been satisfactorily maintained by a small ¼ h.p. motor and roller chain drive. Drip-proof end-plates prevent losses of coating materials retained by the doctor roll reservoirs when the machine is idling or in motion.

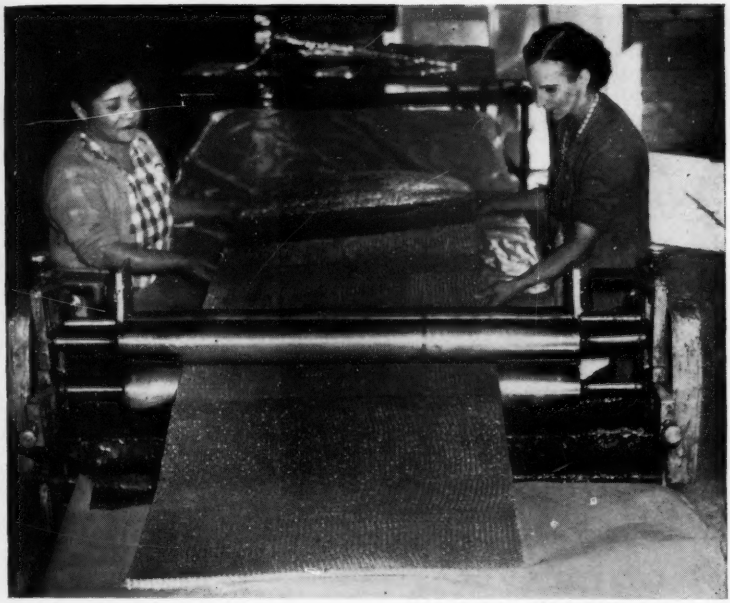
Lengths of the coating rolls determine the maximum widths of the materials that can be finished with each production unit, and to date these have ranged from about 20 in. to 52 in. However, longer or shorter rolls could be used if necessary.

The amount of pressure exerted by the coating rolls on the materials to be finished is somewhat variable, depending on the nature of the deposition surfaces and the viscosity of different coating liquids; but, as a rule, it is not great because the eventual transfer of finishing materials is the result of surface tension—the same phenomenon that is responsible for the transfer of ink to paper in the operation of a mimeograph machine or an offset printing press.

Despite the similarities of roll-coating machines and certain types of printing equipment, no particular efforts have yet been made to adapt the Wallace equipment to production operations involving the use of masks, stencils, or similar devices—probably because screen-processing machines, etc., can be adapted to the same work with greater economy for most practical purposes. However, mechanised coating rolls have been adapted to a number of finishing operations that are unusual. For example:

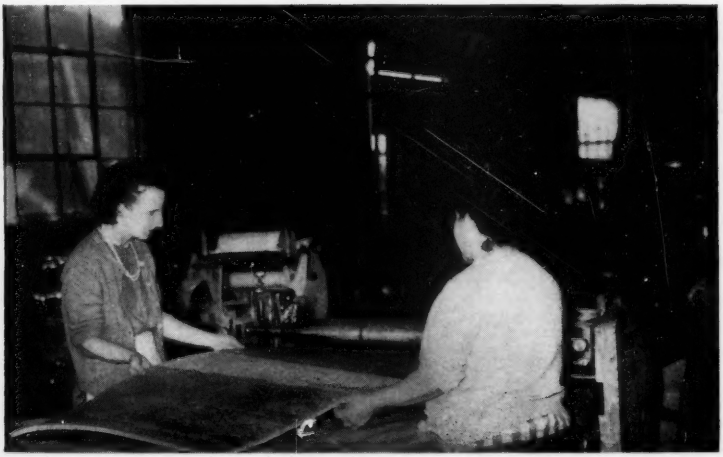
(a) Organic adhesives such as Lauxite and Weldwood have been roll-coated on laminæ for plywood and other "sandwich" structures with greater speed and economy than might be expected in the use of ordinary "glue spreaders" at Fidler Manufacturing Co., Los Angeles, and Schultz Manufacturing Co. of Newark, N.J.

(b) Photosensitive emulsions have been rolled on to wood, paper, glass,



Above: Women workers feed metallic "honeycomb" materials into a roll-coating machine in the Aircraft Die Cutters' plant at Los Angeles

Below: Front view of roll-coating machine showing how coated honeycomb materials are deposited on a cellophane-covered tabletop as they emerge from the machine



Wood veneers are roll-coated, as illustrated here, at Ostling Manufacturing Company of El Monte, California

and many similar surfaces where finishing had to be done in absolute darkness in order to permit the reproduction of line or half-tone illustrations on the coated surfaces with photographic processing equipment. Work of this type has been accomplished by Grant Photo Products of Cleveland, American Gumming Co. of Boston, and Reproduction Co. of Chicago.

(c) Plymouth Rubber Co. of Canton, Mass., has boosted productivity by using mechanised coating rolls for the application of pyroxylin and other organic coatings to leathers, fabrics, and other materials required in the manufacture of shoes.

(d) Viscous organic lubricants are being roll-coated on aluminium sheet materials, so that the latter can be deep-drawn without excessive work hardening due to friction at McClintock Manufacturing Co. of Los Angeles. Similar coatings of a temporary nature would not ordinarily be used on sheet metals, because they could not be applied with reasonable economy.

It is possible that certain types of coating liquids would have an undesirable tendency to react with the surfaces of neoprene-covered rolls in certain circumstances; but most of the commonly-used organic finishing solutions could, if necessary, be preheated to more than 200° F. without damaging the components of a roll-coating machine.

The maintenance of roll-coating machinery is a matter of simple routine. Motors and moving parts must be lubricated at regular intervals to prevent excessive wear. Doctor-roll reservoirs must be reloaded as often as fresh coating materials are required to maintain continuous production operations. Rolls and related machine components should be cleaned with thinners or solvents at the end of each

day's work and parts (such as neoprene roll coverings) should be replaced whenever they begin to deteriorate.

If no special handling fixtures are available, materials are usually roll-finished on one surface at a time—regardless of whether two surfaces must be coated—in order to prevent defects in drying or curing applied coating materials. However, it is not usually a difficult task to devise hooks or similar accessories for the handling of materials with two simultaneously-finished surfaces where production requirements are sufficient to justify the use of special tools.

I.M.F. ORGANIC SECTION

AS recently announced (INDUSTRIAL FINISHING, January, page 424) the Institute of Metal Finishing will be holding the inaugural meeting of the newly-formed Organic Section at the Charing Cross Hotel on Thursday, 19th March.

The meeting will be open to all who are interested in the application of organic finishes, and a cordial welcome is extended to non-members of the Institute as well as to members. Arrangements and time-table will be as follows:

1.0 p.m. *Luncheon* will be served in the Regency Room.

2.30 p.m. *Short business meeting* (in the Canterbury Room), the main purpose of which is to elect the Committee which is to organise the first year of the Group's activities. Mr. H. Silman, B.Sc. (Lond.), F.R.I.C., A.M.I.Chem.E., F.I.M., president of the Institute of Metal Finishing, will be in the chair during this session.

3.0 p.m. *Technical Session* (this will also take place in the Canterbury Room).
Paper: "PROBLEMS OF PAINT APPLICATION." Presented by Mr. A. A. B. Harvey, M.Sc., A.R.I.C. (Briggs Motor Bodies Ltd., Dagenham).

4.20 p.m. *Tea Interval.* Tea and light refreshments will be served without charge.

4.30 p.m. *Technical Session* (continued).
Paper: "PROBLEMS OF DIP AND SPRAY PAINTING." Presented by Mr. D. H. Lloyd, F.R.I.C., F.I.M. (Fisher & Ludlow Ltd., Birmingham).

Mr. L. O. Kekwick, B.Sc., F.R.I.C., president of the Oil and Colour Chemists' Association, will act as chairman during the Technical Session. Following the presentation of each paper, the meeting will be thrown open to general discussion.

COLOURS BY NUMBERS

THE subtleties of colour, colour-blending and colour-mixing are intricate in the extreme and have at all times presented acute difficulties and, indeed, disappointments, to those who specify or use colour, particularly paint-colour.

Distinctive and imaginative names for colours have increased these difficulties, for, whilst some names, such as grass green, prompt a mental perception of that colour, Nature is fickle and cannot always be trusted for a reference, even with her greens. Wedgwood blue is a more stable example, but how many people could strike that shade without a specimen of the ware to guide them?

One may delve into the findings of Boyle, of Newton, Brewster, Chevreu. Ostwald or Munsell and devise highly scientific colour schemes based on their admirable guidance. However, in the realm of paint, with the hitherto restricted colour ranges offered by manufacturers, it has been difficult, if not impossible, to acquire the colours to carry them into effect.

A new system recently introduced by Jenson and Nicholson Ltd. appears to have considerable advantages in the way of simplifying the specification of colours and shades. Known as the "Colourizer" system, it was described at a Press conference by Mr. T. H. Vinnicombe, the sales director, early last month.

By using only two base paints (one white and one grey) and adding one and never more than two "colourants," supplied in collapsible tubes, it is possible to provide 999 pastel tints. The base paint, an alkyd type, is put up in five sizes, gallon, half-gallon, quart, pint and half-pint, while the "colourant" is in tubes of eight sizes. In all there are sixteen "colourants," and it is claimed that from these, plus the white or grey base paint, it is possible to produce, as stated, 999 different tints, 528 from the white, 470 from the grey and, of course, the grey itself. Further, the paint is supplied in four finishes, gloss, eggshell, suede and undercoat.

The 999 colours are provided in the form of an album (which costs £8), and the system is based on numbers and letters, not names. The colour specimens are on detachable slips (supplied separately for 25s.), and when the correct colour is ascertained the key reference is noted. With this reference it is possible to repeat the colour at any time in any quantity, from half-pint upwards.

APPOINTMENTS VACANT

CHEMISTS. Large North London engineering company has the following vacancies for Chemists of the Degree or near Degree standard. Industrial experience preferred but not essential.

1. Analytical Chemists for work entailing the analysis of a wide range of materials and products.
2. Electroplating Chemists to work on problems associated with Electroplating of metals and pre-treatment processes.

These posts offer excellent opportunities of advancement. Write in confidence giving full details to Box No. 69, INDUSTRIAL FINISHING, 157 Hagden Lane, Watford, Herts.

APPOINTMENT VACANT

A **PHYSICS OR ELECTRICAL ENGINEERING GRADUATE** aged about 25 is required for work on problems associated with the application of infra-red heating to industrial processes.—Apply in writing, giving full particulars of age, qualifications and experience to Staff Manager (Ref. RLO/238), Research Laboratories, The General Electric Co. Ltd., North Wembley, Middlesex.

FOR SALE

McGALLIN ENAMELLING CONVEYOR FURNACE 900° C., 10 K.W., 15 amp. with Control Panel, Pyrometer, Switchgear and 40 ft. Conveyor Bench with reduction gear. Box No. 68, INDUSTRIAL FINISHING, 157 Hagden Lane, Watford, Herts.

SHELL SECONDARY BUTYL ALCOHOL PRICES REDUCED

Reduced.—A reduction in price of £20 per ton for their secondary butyl alcohol, with effect from 23rd February, is announced by Shell Chemicals Ltd. The new price is £122 per ton for the 10-ton rate, for delivery in returnable 40/45-gallon drums.

As from the same date 5-gallon and 10-gallon drum lots will be supplied in free, non-returnable containers.

Plastic Flow Cups.—We are advised by the Industrial Finishing Division of British Paints Ltd. that they have available for distribution to *bona fide* users of industrial finishes a number of plastic flow cups which comply with the appropriate British Standard Specification. Applications for this very useful aid to the checking of viscosity should be sent to the head office at Newcastle-upon-Tyne.

Correction. — Under the heading "Moulded Flow Cup" on page 442 of our January issue, we gave details of the new plastic flow cup for viscosity checking. In the announcement the orifice diameter was quoted as 0·156 ± 0·010. This figure should, of course, read 0·156 ± 0·0005 in.

This is an Arrow Press Publication. Published Monthly.
Subscription Rate 30s. per annum.
Published by Arrow Press Ltd. at 157 Hagden Lane, Watford, Herts.
Telegrams: "Techpress, Watford." Telephone: Gadebrook 2308/9.

MADE AND PRINTED IN GREAT BRITAIN FOR THE PROPRIETORS, ARROW PRESS LTD., BY THE SIDNEY PRESS LIMITED, LONDON AND BEDFORD.

ADVERTISERS' INDEX

Aerospray Manufacturing Co. Ltd., The .. —
Aerograph Co. Ltd., The 475
Air Industrial Developments Ltd. 458
Allied Paints and Chemicals Ltd. .. .. —
Ashton and Moore (Metal Colourers) Ltd. —
Atlas Diesel Co. Ltd. 449
Atlas Plating Works Ltd. 523
Ault and Wiborg Group .. .. .. —

Ballard, F. J. and Co. Ltd. .. .. *Cover* iii
Bennett (Hyde) and Co. Ltd. .. .. —
Berger, Lewis (Great Britain) Ltd. .. 458
Bratt Colbran Ltd. .. .. —
British Hydrological Corporation 459
British Oxygen Co. Ltd. 450
British Paints Ltd. .. .. .. *Cover* iv
British Vapour Blast Ltd. .. .. .. —
Brough, E. A. and Co. Ltd. .. .. .. —
Bullows, A. and Sons Ltd. .. .. .. —

Canning, W. and Co. Ltd. 455
Carrier Engineering Co. Ltd. .. .. —
Cellon Ltd. .. .. —
Controlled Heat and Air Ltd. .. .. —
Croda Ltd. 505
Cruickshank, R. Ltd. 497

De La Rue, Thomas and Co. Ltd. .. .. —
Delta Technical and Commercial Services 458
Drummond Patents (Holdings) Ltd. .. 495

Electric Construction Co. Ltd., The .. —
Electro-Chemical Engineering Co. Ltd., The —

Fletcher Miller Ltd. .. .. —

Gas Council, The 452
General Electric Co. Ltd., The 454
General and Industrial Paints Ltd. .. —
Gittings and Hills Ltd. .. .. .. —
Goldsworthy, Thomas and Sons Ltd. .. —
Goodlass, Wall and Co. Ltd. 464
Grauer and Weil Ltd. 524
Griffiths, A. E. (Smethwick) Ltd. 457

Hall, John and Sons (Bristol and London) Ltd. 481
Hawley, John and Co. (Walsall) Ltd. .. 461
Heat and Air Systems Ltd. .. .. .. —
Hockley Chemical Co. Ltd., The .. .. —
Holden, Arthur and Sons Ltd. .. .. —
Honeywell-Brown Ltd. 503

Imperial Chemical Industries Ltd. (Paints Division) .. .. —
Incandescent Heat Co. Ltd. .. .. .. —
Ingham Clark, Robert and Co. .. .. —
International Paints Ltd. .. .. .. *Cover* i
Ionic Plating Co. Ltd. .. .. —

Jenolite Ltd. .. .. —
Jenson and Nicholson Ltd. 483

Kaylee Transfers Ltd. 456
Kearsley, Robert and Co. 460

Learner, A. and Co. Ltd. .. .. .. —

McDowell, Thomas and Co. Ltd. .. .. —
Macpherson, Donald and Co. Ltd. .. .. —
Mander Bros. Ltd. 462
Metallisation Ltd. .. .. —
Metal Porcelains Ltd. .. .. —
Metropolitan-Vickers Electrical Co. Ltd. .. 451
Micafine Ltd. 479
Midland Galvanizers Ltd. 460
Minnesota Mining and Manufacturing Co. Ltd. .. .. —
Modern Industrial Ventilation and Oven Co. Ltd. .. .. —
Morris, B. O. Ltd. 491

Neil and Spencer Ltd. .. .. —
Norgren, C. A. Ltd. .. .. —

Parkinson and Cowan (Gas Meters) Ltd. —
Parsons, Thomas and Sons Ltd. 456
Perfectair Ltd. .. .. —
Pinchin, Johnson and Associates Ltd. .. —
Postans Ltd. .. .. —
Preston, John and Co. Ltd. .. .. —
Prodorite Ltd. .. .. *Cover* ii
Pyrene Co. Ltd., The 493

Scrib Ltd. (Metal Section) 473
Shell Chemicals Ltd. .. .. —
Spencer and Halstead Ltd. .. .. .. —
Stordy Engineering Ltd. .. .. .. —
Sunbeam Anti-Corrosives Ltd. 499

Tack All Tackrag (Eng.) Ltd. .. .. —
Technical Brushes Ltd. .. .. .. —
Teleflex Products Ltd. .. .. .. —
Thornley and Knight Ltd. .. .. .. —
Titanine Ltd. .. .. —
Trapinex Ltd. .. .. —

Walterisation Ltd. 505

VAT AND BARREL PLATING of Chrome, Nickel, Brass, Copper, Zinc, Bright Zinc, Silver, Gold, Cadmium, etc.

Anodising, Bright Dipping, Bronzing, Frosting Aluminium, Polishing and Lacquering, Plating and Bronzing on Aluminium.

ROTO-FINISHING for BURNISHING and DEBURRING.

PROTECTIVE FINISHES FOR ARMAMENTS.

HARD CHROME **ELECTRO-FORMING.**

ATLAS PLATING WORKS LTD., Avenue Rd., Acton, W.3. *ACORN 1102* (3 lines)
Barrel Plating Works, 8/10 INGATE PLACE, Queenstown Rd., Battersea. *Macaulay 2976*

ATLAS PLATING WORKS LTD

G&W LTD

PERFECT POLISHING FOR METALS AND PLASTICS

★ PLEATED MOPS IN VARIOUS GRADES.
PATENT NO. BLF. 632540

★ NO. 3 TRIPOLI. A SUPERIOR POLISHING COMPOSITION FOR BRASS, COPPER AND OTHER METALS.

★ NO. 4 WHITE FINISH. FOR GIVING A HIGH FINISH TO NICKEL, BRASS, SILVER ETC.

GRAUER & WEIL LTD.

ESTABLISHED 1892

HARDWICK STREET, LONDON, E.C.1. Phone: TERMINUS 2434 (2 lines) Grams: GRAUERS SMITH, LONDON.

MANUFACTURERS AND SUPPLIERS OF COMPLETE ELECTRO PLATING PLANTS INCLUDING RECTIFIERS, TANKS, ANODES, SALTS AND CLEANERS